

THE FAUNA OF BRITISH INDIA.

INCLUDING

CEYLON AND BURMA.

*PUBLISHED UNDER THE AUTHORITY OF THE SECRETARY OF
STATE FOR INDIA IN COUNCIL.*

EDITED BY W. T. BLANFORD.

MAMMALIA.

BY

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L O N D O N :

TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET.

CALCUTTA :

THACKER, SPINK, & CO.

BOMBAY :

THACKER & CO., LIMITED.

BERLIN :

R. FRIEDLÄNDER & SOHN, 11 CARLSTRASSE.

1888-91.



PRINTED BY TAYLOR AND FRANCIS
RED LION COURT, FLEET STREET.

PREFACE.

THE first part of this volume, containing the Introduction, Primates, Carnivora, and Insectivora, was published at the end of June 1888. The delay of more than three years in completing the work has been caused by the necessity of devoting a large portion of my time to the editing of the five volumes belonging to the same series that have appeared since the first part of the present work was issued. .

The Mammalia of British India, inclusive of Ceylon and Burma, here enumerated and described, just exceed 400 in number. Jerdon's 'Mammals of India,' published in 1867, contained descriptions of 242 species; but the area as now defined considerably exceeds the limits adopted by Jerdon, who excluded from his work all forms peculiar to Ceylon or Burma, and to all countries north of the main Himalayan range, west of the Indus, or east of the Bay of Bengal and of a line drawn northwards from the head of it. The greatest advance since Jerdon wrote, in our knowledge of Indian Mammals, has been in the orders of Chiroptera, Insectivora, and Rodentia, whilst the order with which, at the present time, our acquaintance is most imperfect is that of Cetacea.

In Sterndale's 'Natural History of the Mammalia of India and Ceylon,' published in 1884, the number of species is 482; but some of these are not found in British Territory, and

several of the forms enumerated, now that better series of specimens have been collected, are no longer regarded as distinct.

Some acknowledgment of the assistance afforded to me in the preparation of the present work will be found in the Introduction. To the list of those who have aided in the publication should be added the Trustees of the Indian Museum, Calcutta, to whom I am indebted for the use of the cuts prepared for Dobson's '*Monograph of Asiatic Chiroptera*,' and for the opportunity of comparing in London some specimens belonging to the Indian Museum. I must also express my particular obligation to Prof. W. H. Flower, Director of the Natural History Collection in the British Museum, for advice and information with regard to the Cetacea; to Mr. R. Lydekker for aid in preparing the account of the Ungulata; to Mr. W. L. Sclater for advance sheets of his Catalogue of Mammalia in the Indian Museum, and for notes on specimens in the Calcutta Collections; and to Mr. Oldfield Thomas, of the British Museum, for assistance and information of every kind, most freely afforded throughout the progress of the work, in connection with the Mammalian Collections under his supervision.

There is another acknowledgment that should perhaps have been made before, but for which the present affords a good occasion. If, as I hope, the present series of works is found useful by Indian naturalists, they will I am sure wish that the names of those who took the first steps in bringing the want of new Handbooks of Indian Zoology to the notice of the Government of India should not remain unrecorded.

The need for new and revised descriptive works had, for some years before 1881, been felt and discussed amongst naturalists in India, but the attention of the Government was, I believe, first called to the matter by a memorial dated Sept. 15th of that year, prepared by Mr. P. L. Sclater, the well-known Secretary of the Zoological Society, signed by

PREFACE.

Mr. Charles Darwin, Sir J. Hooker, Professor Huxley, Sir J. Lubbock, Prof. W. H. Flower, and by Mr. Slater himself, and presented to the Secretary of State for India. This memorial recommended the preparation of a series of Hand-books of Indian Zoology and my appointment as Editor. It is scarcely necessary to add that to the recommendation of men so highly respected, and so well known in the world of Science the publication of the present 'Fauna of British India' is greatly due, and that Mr. Slater is entitled to the thanks of all interested in the Zoology of India for the important part he took in the transaction. I can only express a hope that the present series as a whole may be worthy of the distinguished support to which, in so great a degree, it owes its origin.

With the publication of this part six out of the seven volumes in which it was originally proposed to describe the Vertebrata of British India have been completed. The remaining volume of Birds will be undertaken at once. I am glad to be able to announce that the 'Fauna of British India' will not be confined to Vertebrata, the preparation of three volumes on Moths by Mr. G. F. Hampson having been commenced.

W. T. BLANFORD.

November 30th, 1891.

Volant mammals, having their fore limbs specially modified for flight. The forearm consists of a rudimentary ulna, a long curved radius, and a carpus of six bones supporting a thumb and four greatly elongated fingers, between which, the sides of the body, and the hinder extremities a thin expansion of the integument (the *wing-membrane*) is spread out. The knee is directed backwards, owing to the rotation of the hind limb outward by the wing-membrane; a peculiar elongated cartilaginous process (the *calcaneum*), rarely rudimentary or absent, arising from the inner side of the ankle-joint, is directed inwards and supports part of

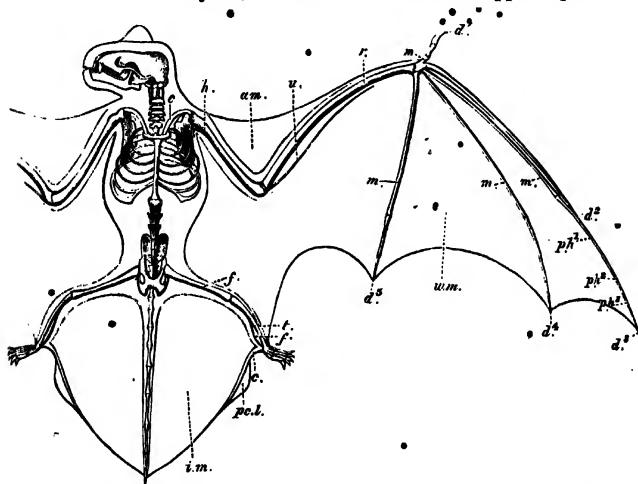


Fig. 72.—Skeleton and Volar Membranes of the Noctule (*Vesperugo noctula*), half nat. size. (Flower, Art. Mammalia, 'Encyclopædia Britannica.')

c., clavicle; *h.*, humerus; *r.*, radius; *u.*, ulna (rudimentary); *d.*¹, first digit or pollex; *d.*², *d.*³, *d.*⁴, *d.*⁵, other digits supporting *w.m.*, the wing-membrane; *m.*, *m.*, metacarpal bones; *ph.*¹, *ph.*², *ph.*³, first, second, and third phalanx of third digit; *am.*, antebrachial membrane; *f.*, femur; *t.*, tibia; *f.*, fibula (rudimentary); *c.*, calcaneum or calcar supporting *i.m.*, the interfemoral membrane; *pc.l.*, post-calcaneal lobe.

the posterior margin of an accessory membrane of flight, extending from the tail or posterior extremity of the body to the hinder limbs (the *interfemoral membrane*). The penis is pendent, the

testes abdominal or inguinal; the mammary glands thoracic, and generally post-axillary; the uterus simple or two-horned; the placenta discoidal and deciduate; and the smooth cerebral hemispheres do not extend backwards over the cerebellum. The dental series consists of four kinds of teeth: incisors, canines, premolars, and molars; and the dental formula never exceeds $i. \frac{4}{6}, c. \frac{1-1}{1-1}, pm. \frac{3-3}{3-3}, m. \frac{3-3}{3-3} = 38$ teeth (*Dobson*).

Besides the "wing-membrane" and "interfemoral membrane," there is a smaller membrane in front of the humerus and forearm called the "antebrachial membrane." The relative position of the different membranes, and of the bones supporting the wing-membrane, is shown in the accompanying woodcut (fig. 72). The manus or hand is always composed of five digits; of these the first (or thumb), fourth, and fifth consist each of a metacarpal and two osseous phalanges, in the second and third the number of phalanges varies slightly. The first digit or thumb is partly free from the wing and always terminates in a claw. The hind limb is but poorly developed.

Few, if any, animals have so delicate a sense of touch as bats. In Spallanzani's experiments, bats deprived of the power of seeing, hearing, or smelling, flew through a room, carefully avoiding the numerous threads that were stretched across it. This sense of touch, so acute as to feel the slightest movements of the air, is probably chiefly exercised by the wing-membrane, the greatly developed ear-conch, and, in the leaf-nosed bats, by peculiarly formed expansions of integument around the nostrils. In several families of insectivorous bats, a process called the tragus arises inside the inner or anterior margin of the ear (fig. 73), whilst a lobe at the base of the outer margin opposite the tragus, and known as the antitragus, is sometimes of considerable dimensions. The ears are extremely mobile.

Bats vary in their powers of flight almost as greatly as birds do,

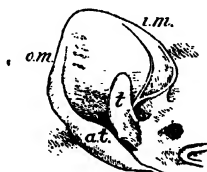


Fig. 73.—Ear of *Vesperugo abramus*.

o.m., outer margin; *i.m.*, inner margin; *t.*, tragus; *a.t.*, antitragus.

those with long narrow wings being much swifter than the short-winged forms. The species of stronger flight appear, as a rule, earlier in the evening, even in some cases before sunset, and may often be seen hawking insects in company with swallows and

swifts, high in the air. Several kinds of *Vesperugo*, *Miniopterus*, *Megaderma*, and *Nycticejus* may be cited amongst the swiftest flying forms.* On the other hand, the species of *Rhinolophidae* and those belonging to the genus *Vespertilio* have a comparatively slow flight and rarely rise far from the ground. They appear as a rule later in the evening, and only in fine weather. Some of the longer-winged bats, especially the species of *Vesperugo*, are easily distinguished on the wing by the quickness with which they change the direction of their flight. More observations of the flight and habits in general of Indian bats are needed.

From the weakness and reversed position of the hind limbs, bats are unable to walk like other mammals, and when, from any cause, they are induced to descend to the ground, they make most awkward attempts to progress on all fours, their thumbs being mainly used in locomotion. By means of the claws on the toes and that on the thumb, they can climb up any uneven sloping or vertical surface. When at rest they suspend themselves by their hind feet to trees, or in caves, old buildings, &c., and remain hanging head downwards. When moving about, they also hang by their thumbs. The young one is carried by the mother until nearly her own size. Usually one is produced at a birth, but at most two. Amongst many bats the sexes live apart except at the pairing-season. As in the *Primates*, the females have only two pectoral teats, but in certain families a pair of nipple-shaped appendages are developed in the inguinal region.

In temperate regions bats hibernate in the winter, a number of them being frequently found huddled together. Some observers have supposed that no hibernation takes place in India; but the insectivorous forms, in Northern India at all events, are but rarely seen abroad during the cold season, though the *Pteropidae* are as active as at other times.

Bats were by Linnæus classed amongst the *Primates*, and, until recently, many naturalists assigned to the *Chiroptera* a very high position amongst *Mammalia*. It has, however, been shown that the true position of bats is next to the *Insectivora*, and that both, with their poorly developed brains, are of inferior grade.

A complete account of the order has been published by Dobson in his 'Catalogue of the Chiroptera in the Collection of the British Museum,' from which work and the same author's 'Monograph of the Asiatic Chiroptera' the following descriptions of the Indian members of the order are chiefly taken.

The bats are by Dobson and others classed in two principal divisions called suborders, but not distinguished by characters of similar importance to those which serve to separate the *Pinnipedia* from *Fissipedia* in *Carnivora*, and the *Dermoptera* from the true *Insectivora*. The first of these suborders includes a single family of frugivorous bats; to the other belong the five families of insectivorous *Chiroptera*. All are thus discriminated:—

- A. Crowns of the molar teeth with a longitudinal furrow, not tubercular; second or index finger with three phalanges besides the metacarpal bone, and generally terminating in a claw (in all Indian genera except *Eonycteris*); the two margins of each ear-conch meeting at the base. Frugivorous

I. MEGACHIROPTERA.
Pteropodidæ.

- B. Crowns of the molar teeth acutely tubercular, with transverse furrows; second or index finger with a single rudimentary phalanx (in *Rhinopoma* only with two phalanges) and clawless; the two margins of each ear-conch arising from the head separately. Carnivorous, and, for the most part, insectivorous

II. MICROCHIROPTERA.

- a. Tail contained within the interfemoral membrane, or very little produced beyond its hinder margin. First phalanx of middle finger extended, in repose, in a line with the metacarpal bone.

a'. Tragus none, a complicated nose-leaf

b'. Tragus present, a nose-leaf

c'. Tragus present, no nose-leaf

- b. Tail perforating the interfemoral membrane and appearing on its upper surface, or produced considerably beyond the truncated membrane; first phalanx of middle finger folded, in repose, on the dorsal surface of the metacarpal bone.

a'. Two osseous phalanges (besides metacarpal bone) in middle finger. Tragus distinct, no nose-leaf

b'. Three phalanges in middle finger.

Rhinolophidæ.
Nycteridæ.
Vespertilionidæ.

Emballonuridæ.
Phyllostomatidæ
(American).

All of the families except the *Phyllostomatidæ* are represented in India.

The measurements of bats are in almost every case taken from specimens preserved in alcohol. Like all other mammals, bats vary considerably in their dimensions, the figures quoted being, when several measurements are available, those of an average specimen.

Bats are known generally as *Chamgudar* in Hindi; *Shab-par* or *Shab-parak* in Dakhani; *Chamgúduri*, Bengali; *Chidgu* at Bhagulpur; *Chittú bardwi* in Ho Kol; *Gabbelai* or *Jiburai*, Telugu; *Kanka-pati*, Canaresse; *Vuthá*, Cingalese; *Phiyu longtd*, Bhotia; *Brin*, Lepcha; *Soshiro*, *Phakardng*, and *Sepcha*, Naga. These names are used for all species of Microchiroptera.

Suborder *MEGACHIROPTERA*.

Family PTEROPODIDÆ.

This family consists of the fruit-eating bats, the largest of which are commonly known in India as flying-foxes. Some smaller forms, of less conspicuous coloration, are also comprised. All are distinguished from other bats by the characters of the molar teeth, with longitudinally grooved crowns, by the bony palate being continued, narrowing slowly backwards, behind the last molars, and especially by the form of the ear, the margins of which meet before they reach the head, so that the whole margin forms a more or less regular oval ring, whilst in all insectivorous bats the margins arise independently from the head. As a rule, too, the index finger terminates in a claw, *Eonycteris spelæa* being the only exception to the rule found in the territory of British India.

The following genera occur within the Indian area :—

- | | |
|---|----------------|
| A. Tongue moderate; inner margin of nostril projecting; a claw to index finger. | |
| a. No tail, hind neck and shoulders generally much paler than back | PTEROPUS. |
| b. A tail generally present; upper parts of one colour throughout. | |
| a'. 5 teeth in upper molar series, 6 in lower ... | XANTHARPYIA. |
| b'. 4 teeth in upper molar series, 5 in lower ... | CYNOPTERUS. |
| B. Tongue very long; no projecting margin to nostril. | |
| a. A claw to index; wing from base of 4th toe; tail rudimentary | CARPONYCTERIS. |
| b. No claw to index; wing from base of 1st toe; tail distinct | EONYCTERIS. |

All the *Pteropodidæ* are limited to the tropical and subtropical regions of the Eastern hemisphere with Australia, none being found in America.

Genus *PTEROPUS*, Brisson (1756).

Size large, exceeding all other bats. Muzzle long; nostrils projecting by their inner margins, between which is a deep furrow leading to a vertical groove that divides the upper lip, and has on each side a naked swollen border. Second* or index finger with a distinct claw; metacarpal bone of third or middle finger shorter than second finger. Wing-membrane from the sides of the hairy

* The thumb, which is free, being classed as the first finger.

back, and the back of the second toe. Tail none. Hair of the hind neck and shoulders different in quality from that of the back, and generally much brighter in colour.

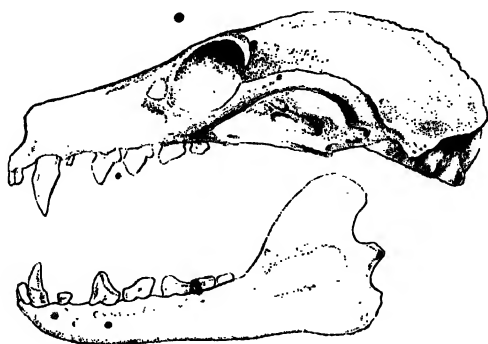


Fig. 74.—Skull of *Pteropus medius*.

Dentition: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{2-2}{3-3}$. Upper incisors in a semicircular row, separated on each side from the canines; lower outer incisors close to the canines, the inner pair generally separated by a slight interval and smaller; first upper premolars generally very small and deciduous.

This genus contains the large fruit-bats commonly known in India as flying-foxes.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Forearm (radius) in adults less than 7 inches long.
 - a. Ears pointed, longer than distance from eye to muzzle..... *P. medius*, p. 257.
 - b. Ears rounded, shorter than distance from eye to muzzle..... *P. nicobaricus*, p. 260.
- B. Forearm in adults more than 8 inches long; ears pointed *P. edulis*, p. 259.

Beyond India the genus *Pteropus* has a remarkable geographical distribution. The majority of the species inhabit the Malay Archipelago, on both sides of Wallace's line; the range of the genus extending eastward to Samoa, south throughout a considerable part of Australia (not to New Zealand or Tasmania), and eastward to Madagascar and the Comoro Islands, but not to Africa.

184. *Pteropus medius*. *The Indian Fruit-Bat or Flying-Fox.*

- Pteropus medius*, Temm. *Mon. Mam.* i, p. 176 (1827); Dobson, *J. A. S. B.* xlii, pt. 2, p. 196, pl. xiv, fig. 1 (ear); *id.* *Mon. As. Chir.* p. 18; *id.* *Cat. Chir. B. M.* p. 51; Blyth, *Mam. Birds Burma*, p. 14; Anderson, *Cat.* p. 101; Scully, *J. A. S. B.* lvi, pt. 2, p. 236. *Pteropus edwardsi*, Horsfield, *Cat.* p. 28; Kelaart, *Prod.* p. 27; Adams, *P. Z. S.* 1858, p. 512; Blyth, *Cat.* p. 20; Jerdon, *Mam.* p. 18; Hutton, *P. Z. S.* 1872, p. 691; *nec* Geoffr. *Pteropus leucocephalus*, Hodgson, *J. A. S. B.* iv, p. 700 (1835). *Pteropus assamensis*, McClelland, *P. Z. S.* 1830, p. 148. *Pteropus kelaartii*, Gray, *Cat. Monkeys, Lemurs, and Fruit-eating Bats B. M.* p. 104 (1870).

Gadal, *Barbagal*, *Bádúr*, *Pata debli*, H.; *Bádúl*, Beng.; *Warbagúl*, Mahr.; *Toggal báwuli*, Can.; *Sikat yelle*, Wadari; *Sikurayi*, Tel.; *Barwalu*, Mal.; *Loco-waola*, *Wawal*, Cing.; *Leng-tshwai*, *Leng-nek*, Burmese.

Ears naked and acutely pointed, their length exceeding the distance from the eye to the end of the nose; the outer margin concave near the tip. Nose naked above. Fur of hind-head, neck all round, shoulders, and breast woolly, coarser and longer than that of the back. There is a narrow hairy band above the wing-membrane behind the humerus and part of the forearm, and the interfemoral membrane is covered with hair above except near the edge. In males there is generally a circular tuft of rigid greasy hairs, bright reddish in colour, on each side of the neck.

Colour. This is variable, as in all bats. The head is generally reddish brown, the muzzle often darker and sometimes black; the hind neck and shoulders paler, generally pale brownish yellow to straw-colour; back behind the shoulders dark brown or black, occasionally with a few white hairs interspersed. Lower parts yellowish brown, chin and fore neck usually darker, as are the region about the vent and the flanks; sometimes the whole lower breast and abdomen are dark brown or black.

Dimensions. Head and body about 9 inches (varying from 7·5 to 10·5), length of ear from orifice 1·45, forearm 6·6; basal length of skull 2·7, extreme length 2·9, zygomatic breadth 1·7. The expanse of the wings is about 4 feet. Weight 20 to 22 oz.

Distribution. Throughout India, Ceylon, and Burma. Not found in the Himalayas except near the base, or as a visitor from the plains. Rare in Western Rajputana, Cutch, and Sind, and not known to occur in the Punjab. Not recorded east or south of Burma.

Habits. Jerdon's account is good. He says:—"During the day they roost on trees*, generally in large colonies. Many hundreds often occupy a single tree, to which they invariably resort if not driven way. Towards sunset they begin to get restless, move

* Tickell notices their preference for tamarind trees, and I think he is right. In Bengal they sometimes remain on bamboos. They hang head downwards, wrapped in their wings, and precisely resemble large dead leaves.

about along the branches, and by ones and twos fly off for their nightly rounds. If water is at hand—a tank, a river, or the sea—they fly cautiously down and touch the water, but I could not ascertain if they took a sip, or merely dipped part of their bodies in. They fly vast distances occasionally to such trees as happen to be in fruit. They are fond of most garden fruit (except oranges, &c.), also the neem, jamoon, ber, and various figs*. About the early dawn they return from their hunting-grounds, and the scene that then takes place is well described by Tickell in an excellent memoir published in the ‘Calcutta Journal of Natural History’ †, from which I extract the following: ‘From the arrival of the first comer until the sun is high above the horizon, a scene of incessant wrangling and contention is enacted amongst them, as each endeavours to secure a higher and better place, or to eject a neighbour from too close vicinage. In these struggles the bats hook themselves along the branches, scrambling about “hand over hand” with some speed, biting each other severely, striking out with the long claw of the thumb, and shrieking and cackling without intermission. Each new arrival is compelled to fly several times round the tree, being threatened from all points, and when he eventually hooks on has to go through a series of combats, and be probably ejected two or three times before he makes good his tenure. The “alarums-excursions” continue till 8, 9, or 10 A.M., when the bats get sleepy, and hang side by side in peace, fanning themselves with their wings, which in repose they wrap round the head.’”

According to Dr. Shortt, P. Z. S. 1863, p. 438, these bats capture small fish, but Jerdon suspects, and probably with reason, that the habit of skimming water in the evening has been mistaken for fishing. I have often observed this habit: the head is lowered, the animal pauses in its flight, and the water is just touched, I believe, by the tongue or lower jaw. I have no doubt that some water is drunk, and this is the opinion of both Tickell and McMaster. The former says that flying-foxes in confinement drink at all hours, lapping with their tongues. The latter has noticed many other bats drink in the evening as well as the flying-foxes.

The process of eating is also described by Tickell. The bats hang, head downwards as usual, by one foot, and hold the fruit with the other, not by grasping, but by striking the claws in like a fork. The jaws are moved slowly up and down, and the food

* They are also fond of the fruit of *Terminalia catappa*, and are said by Day to extract the kernels, often utilizing the verandahs of houses as a resort whilst thus engaged, and alarming the inhabitants by sounds suggestive of house-breaking. The same writer states that these bats often drink toddy (palm-juice) from the pots attached to the trees from which it is collected, and are consequently found intoxicated and helpless beneath the trees in the morning (‘Land of the Permauls,’ p. 439).

† Vol. iii. p. 29.

bitten off in large mouthfuls, both cheeks being crammed full and the tongue protruded.

The numbers in a colony are at times very great, and the trees on which the bats perch are frequently injured and sometimes killed. *Pteropi* fly singly, never in a flock, with a steady but not very rapid flight. Anderson counted, in Calcutta, 70 passing per minute, for about half an hour, over a breadth of about 250 yards, but others could be seen on all sides as far as the eye could detect them. This was in the twilight immediately after sunset. McMaster, at Rangoon, counted, with the help of a friend, 600 passing in five minutes.

Jerdon relates an instance, in the Ghazipur district, of several individuals being killed by a hot dry wind, and McMaster states the same has been observed at Madras.

P. medius has a peculiar offensive musky smell, by which its presence in the neighbourhood may often be detected. This smell Dobson attributes to the secretion from the glands marked by coarse hair on each side of the neck. But these glands are said to be peculiar to the male, whilst, according to Tickell, the female has an equally evil odour.

The power of flight in this species is sufficient to enable it to visit fruit-trees many miles distant from its resting-place. Stern-dale records having captured one alive, though tired, at sea, 200 miles from the nearest land.

The common Indian flying-fox is easily tamed. The flesh is eaten by many classes of natives of India, and is said by some Europeans, who have tried it, to be well flavoured and delicate.

The female has but one young (as have most other bats) at a birth, usually born, according to Tickell, about the end of March or in April, and carried about by the mother until the end of May or the beginning of June, by which time the young animal is nearly as large as its parent.

135. *Pteropus edulis*. *The Malay Flying-Fox*.

Pteropus edulis, Geoffroy, *Ann. Mus.* xv, p. 90 (1810); Cantor, *J. A. S. B.* xv, p. 186; Blyth, *Cat.* p. 20; Dobson, *J. A. S. B.* xlii, pt. 2, p. 199, pl. xiv, fig. 3 (ear); *id.* *Mon. As. Chir.* p. 20; *id.* *Cat. Chir. B. M.* p. 49; Anderson, *Cat.* p. 100.

Kluang, Malay.

The largest bat known, the size being larger than that of *P. medius*. Ears naked, acutely pointed, longer than the distance from the eye to the end of the nose, narrower than those of *P. medius* (the breadth being only half the length), upper outer margin but slightly concave. The wing-membrane arises farther from the middle of the back, and the hairy back is much broader, otherwise the distribution of the fur is similar.

Colour generally similar to that of *P. medius*, but rather darker. Head and breast rufous-brown, varying in tint; hind neck and

back between the shoulders paler yellowish or rufous-brown, or sometimes bright rufous; back dark brown or black with a mixture of grey hairs; lower parts either rufous-brown throughout, or the lower breast and abdomen nearly black with an intermixture of grey. Some specimens are black throughout.

Dimensions. Head and body 12 inches, ear from orifice 1.75, forearm 8.8; basal length of skull 3, zygomatic breadth 1.75. The expanse of the wings is fully 5 feet.

Distribution. The Indo-Malayan subregion (Malayan Peninsula, Sumatra, Java, Borneo, Philippines, &c.), extending, it is said, to the Nicobar and Andaman Islands, and perhaps into Southern Tenasserim, a specimen from Mergui, in bad condition however, having been referred to this species by Blyth. This species was obtained by Anderson in the Mergui Archipelago.

The habits are similar to those of *P. medius*.

136. *Pteropus nicobaricus*. *The Nicobar Flying-Fox*.

Pteropus nicobaricus, *Fitzinger, Sitzb. Wien. Ak.* xlii, 1861, p. 380 (no description); *Zelevor, Novara, Reise, Säugeth.* p. 11 (1868); *Dobson, J. A. S. B.* xlii, pt. 2, p. 198, pl. xiv, f. 2 (ear); *id. Mon. As. Chir.* p. 17; *id. Cat. Chir. B. M.* p. 54; *Anderson, Cat.* p. 102.

Pteropus melanotus, *Blyth, Cat.* p. 20 (1863) (no description).

Size of *P. medius*. Ears naked, short, rounded at the tip, their breadth when laid flat about three-quarters of the length, which is less than the distance from the eye to the end of the nose. Wing from the back and distribution of fur as in *P. medius*. Skull rather shorter and broader.



Fig. 75.—Head of *Pteropus nicobaricus*. (Dobson, *Mon. As. Chir.*)

Colour. In males the coloration is sometimes as in *P. medius*, but generally darker; head dark brown above and below; hind neck and between shoulders rufous to yellowish brown; back dark brown: lower parts brown, paler in the middle of the abdomen. Young males and females often intensely black throughout, or with only an indication of the pale collar.

Dimensions. Head and body 9 inches long (varying from 8 to 10.5), ear 1.05, forearm 6.5; total length of skull 3, basal length 2.7, zygomatic breadth 1.4 (*Zelevor*).

Distribution. Andaman and Nicobar Islands; a variety (*P. condorensis*, Peters) from Pulo Condore; Java is also given by Dobson. A skull is recorded in Anderson's 'Catalogue' from Mergui, but the locality is very doubtful, as the history of the specimen is unknown.

Genus **XANTHARPYIA**, Gray (1843).

Syn. *Eleutherura*, Gray (1844); *Cynonycteris*, Peters (1852).

Size moderate, muzzle long; nostrils projecting by their inner margins, between which is a wide furrow, leading to a broad groove across the upper lip; the margins of this groove are naked, but less swollen than in *Pteropus*. Second or index finger with a distinct claw; metacarpal bone of the middle finger as long as the index finger or longer. Wings from the sides of the hairy back and from the base of the second toe. Tail short but distinct, partially included in the narrow interfemoral membrane. Fur of the back and shoulders of the same colour and quality throughout.

Dentition: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{2-2}{3-3}$.

This genus and the next three are distinguished from *Pteropus* by smaller size and duller coloration.

Only a single species is known within Indian limits. The genus ranges throughout Southern Asia, extending eastward into the Malay Archipelago and westward into Africa.

137. **Xantharpyia amplexicaudata.** *The fulvous Fruit-Bat.*

Pteropus amplexicaudatus, Geoff. *Ann. Mus.* xv, p. 96 (1810).

Pteropus leschenaultii, Desm. *Mamm.* p. 110 (1822); Kelaart, *Prod.*

p. 27, *Blyth, Cat.* p. 21; *Jerdon, Mamm.* p. 19.

Pteropus pyrivorus, Hodgs. *J. A. S. B.* iv, p. 700 (1835).

Cynonycteris amplexicaudata, Peters, *MB. Akad. Berl.* 1867 p. 865; *Dobson, P. A. S. B.* 1872, p. 154; *id. J. A. S. B.* xlii, pt. 2, p. 202, pl. xiv, fig. 8 (ear); *id. P. A. S. B.* 1873, p. 110; *id. Mon. As. Chir.* p. 29; *id. Cat. Chir. B. M.* p. 72; *Anderson, Cat.* p. 103; *Scully, J. A. S. B.* lvi, pt. 2, p. 237.

Ears almost naked, oval, rounded at the tip; outer margin with a distinct though small convex lobe at the base. Fur short. First upper premolar minute, equally distant from the canine and the second premolar.

Colour of fur brown, varying in tint, the lower parts duller than the upper.

Dimensions. Length of head and body 5 inches, tail 0.7, forearm 3.35, ear from orifice 0.75; total length of skull 1.5, zygomatic breadth 0.9.

Distribution. Throughout the greater part of India, Ceylon, and Burma. This species is recorded from the Himalayas (base only), Sind, Singbhoom, Madras, Trichinopoly, Ceylon, Pegu, and Moulmein, but it is not commonly



Fig. 76.- Ear of *X. amplexicaudata*. (Dobson, *Mon. As. Chir.*)

met with and appears to be of local distribution. It extends on the west to the Persian Gulf, where I obtained specimens, on the east and south-east throughout the Malay Archipelago to the Philippines and Timor.

Habits. This is, in many cases at all events, a cave-haunting bat. I shot several in the large salt-caves of Kishm Island, Persian Gulf, where it abounded, and Mr. Murray found it in old tombs and in caves near Karachi. An allied species, *X. ægyptiaca*, inhabits the chambers of the Pyramids and has been found in a cave in Palestine.

Like the other fruit-bats, this animal is very voracious and possesses great powers of flight. According to Hodgson, it has been known to travel 30 or 40 miles and to return in a single night. Scully has shown that bats of this species, visiting the Nepal Valley, probably come from the Nowakot district, only 16 miles distant, not from the plains, as Hodgson supposed. Dobson was informed that near Moulmein a colony of *X. ampleuraudata* was found to feed on *môkusca* left exposed by the tide.

Genus **CYNOPTERUS**, F. Cuv. (1825).

Syn. *Pachysoma*, Geoffr. (1828).

Muzzle much shorter and blunter than in *Pteropus* or *Xanthopyia*; nostrils projecting by their inner margins, between which is a broad furrow. A shallow vertical groove crosses the middle of the upper lip and has broad naked margins. Index finger with a distinct claw; metacarpal bone of the middle finger as long as the index finger or longer; wings from the sides of the hairy back and from the base of the first toe.

Dentition in all Indian forms: i. $\frac{4}{1}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{1-1}{2-2}$.

This genus is found throughout the Oriental region.

Synopsis of Indian, Ceylonese, and Burmese Species.

- | | |
|--|--------------------------------|
| A. Tail present. | |
| a. Base of outer margin of ear-conch straight or faintly convex. | |
| a'. Ears nearly double the length of the muzzle and margined with white . . . | <i>C. marginatus</i> , p. 263. |
| b'. Ears not much longer than muzzle and with white borders | <i>C. brachyotus</i> , p. 264. |
| c'. Ears not much longer than muzzle, without white border | <i>C. scherzeri</i> , p. 264. |
| b. Base of outer margin of ear-conch forming a distinct rounded projection | <i>C. brachysoma</i> , p. 264. |
| B. No tail | <i>C. blanfordi</i> , p. 265. |

138. *Cynopterus marginatus*. *The short-nosed Fruit-Bat.*

Pteropus marginatus, Geoff. *Ann. Mus.* xv, p. 57 (1810).

Cynopterus marginatus, Blyth, *J. A. S. B.* xiii, p. 479; *id. Cat.* p. 22; *id. Mam. Birds Burma*, p. 15; Elliot, *Mad. Jour. L. S.* x, p. 96; Cantor, *J. A. S. B.* xv, p. 187; Kelaart, *Prod.* p. 28; Jerdon, *Mam.* p. 20; Hutton, *P. Z. S.* 1872, p. 693; Dobson, *J. A. S. B.* xlii, pt. 2, p. 200, pl. xiv, f. 4 (ear); *id. Mon. Asiat. Chir.* p. 24; *id. Cat. Chir. B. M.* p. 81; Anderson, *Cat.* p. 104; Scully, *J. A. S. B.* lvi, pt. 2, p. 239.

Cham-gadili, Beng.; *Chota badur*, II.; *Lenzwe*, *Lenwet*, Burm.

Ears nearly naked, rounded at the tip, about twice the distance from eye to nostril in length, without any prominent basal lobe to

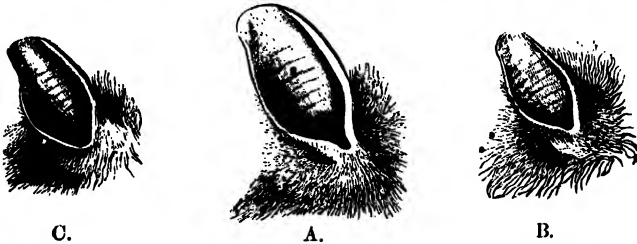


Fig. 77.—Ears of: A, *Cynopterus marginatus*; B, *C. brachyotus*; C, *C. scherzeri*. (Dobson, *Mon. As. Chir.*)

the outer margin. First upper premolar minute, in the middle of the space between the canine and the second premolar, and slightly on the outer side of the tooth-row.

Colour brown, very variable in tint, generally snuff-brown or umber-brown, but some individuals are ferruginous or yellowish brown, others dull grey-brown. Males, especially in the breeding-season, have a collar of stiff reddish-yellow or rusty-brown hairs. Outer and inner margins of ear-conch and sometimes the whole margin to the tip white.

Dimensions. Head and body 4·4 inches, tail 0·4, ear from orifice 1, forcarin 3; skull, total length 1·45, zygomatic breadth 0·95.

Distribution. Common throughout India from the base of the Himalayas to Lake Comorin; also Ceylon, Burma, the Malay Peninsula and Archipelago to the Philippines. Not known to occur west of Sind, where, however, it is by no means rare.

Habits. This bat is found on trees in the daytime. I have observed it solitary in forest, but Jerdon states that it roosts in companies on the folded leaves of plantains, Palmyra palms, and other trees. Tickell records having occasionally met with it in caverns and in hollow trees. It lives entirely on fruit and is extremely destructive to plantains, guavas, and mangoes. Its voracity is mentioned by almost every observer. One instance will suffice. Dobson gave to an individual in Calcutta a plantain weighing, with the skin removed, two ounces. The whole fruit was consumed in three hours, whilst the bat, when killed next morning, weighed only one ounce.

Blyth notes that the flight of this species is particularly light and buoyant, very different from the direct heavy flight of *Pteropus*, but the general manners and voice of the two are very similar.

139. *Cynopterus brachyotus*. ' *The Andaman short-nosed Fruit-Bat*.

Cynopterus brachyotus, S. Müller; *Tijdsch. Natuur. Gesch.* v, p. 146 (1839).

Cynopterus marginatus, var. *andamanensis*, Dobson, *J. A. S. B.* xlii, pt. 2, p. 201, pl. xiv, fig. 5 (ear).

Cynopterus brachyotus, Dobson, *Mon. As. Chir.* p. 26; Scully, *J. A. S. B.* lvi, pt. 2, p. 239.

This resembles the previous species in all respects except in having much smaller ears, which measure from the orifice 0·7 instead of 1 inch.

Dimensions of a female: head and body 3·7 inches, tail 0·4, ear as above 0·7, forearm 2·6.

Distribution. Andaman Islands and Borneo. Scully states that two specimens, obtained by him in Nepal, agree with this form in the size of the ears.

140. *Cynopterus scherzeri*. *The Nicobar short-nosed Fruit-Bat*.

Pachysoma scherzeri, Fitzinger, *Sitzungsb. Wien. Akad.* xlii, p. 390 (1861) (no description); Zelebor, *Novara, Reise, Säugeth.* p. 13 (1868).

Cynopterus scherzeri, Dobson, *J. A. S. B.* xlii, pt. 2, p. 201, pl. xiv, fig. 6 (ear); *id. Mon. As. Chir.* p. 26; *id. Cat. Chir. B. M.* p. 84; Anderson, *Cat.* p. 106.

Ears naked, rounded at the tip, without any distinct basal lobe to the outer margin, and but slightly exceeding in length the distance from the eye to the nostril. Muzzle broader than in *C. marginatus*, and frontal region narrower.

Colour dark brown. According to Dobson the ears have no white edges, but I think there are traces of white on the inner margins of the ears in a British Museum specimen.

Dimensions. Head and body of a female 3·7 inches long, tail 0·55, ear from orifice 0·6, forearm 2·7.

Distribution. The types were from Car-Nicobar Island, where the species was found on the leaves of cocoa-nut palms by the 'Novara' Expedition and subsequently by Dr. Stoliczka and others. Another specimen, apparently of this form, from Timor, is in the British Museum.

141. *Cynopterus brachysoma*. *The thick-bodied Fruit-Bat*.

Cynopterus brachysoma, Dobson, *J. A. S. B.* xl, pt. 2, p. 200 (1871), xlii, pt. 2, p. 202, pl. xiv, fig. 7 (ear); *id. Mon. As. Chir.* p. 27; *id. Cat. Chir. B. M.* p. 85; Anderson, *Cat.* p. 106.

Ears rounded at the tip, and furnished with a prominent rounded lobe at the base of the outer margin; their length from

the orifice slightly exceeds that of the muzzle from the eye to the nostril. Body very short and thick. Tail very short and slender and completely concealed by the fur, which is long and dense.

Colour slaty blue with a greyish or silvery tinge, tips of the hairs sooty brown.

Dimensions of an adult female: head and body 2.9 inches, tail 0.25, ear from orifice 0.6, forearm 2.2.

Distribution. South Andaman Island, whence a single specimen, the only one hitherto recorded, was obtained by Dr. Stoliczka.

142. **Cynopterus blanfordi.** *The tailless short-nosed Fruit-Bat.*

Cynopterus blanfordi, Thomas, *Ann. Mus. Civ. Genova*, ser. 2 a, x (1891).

No tail. Only a trace of an interfemoral membrane. Ears naked, rounded at the tip, a distinct lobe at the base of the outer margin. Fur long on the body and legs and especially between the legs.

Colour dark brown with a greyish tinge, inner margin of the ear whitish.

Dimensions of an adult female in spirit: head and body 2.5 inches, ear from orifice 0.6, forearm 2.

Distribution. Karennee, where specimens were obtained by Mr. Fea.

Genus **CARPONYCTERIS**, Lydekker (1891).

Syn. *Macroglossus*, F. Cuv. (1825); nec *Macroglossa*, Ochs. (1816).

Muzzle cylindrical, very long and narrow; nostrils with the margins not projecting, though a shallow groove divides them. In some cases this is continued as a fine vertical impressed line across the upper lip, but generally the upper lip is not grooved; it is naked and convex in the middle. Tongue very long and attenuated, covered with numerous long brush-like papillæ. Index finger with a claw, metacarpal bone of middle finger equal to the index finger or longer than it. Wings from the sides of the hairy back and from the base of the fourth toe; tail very short, quite rudimentary or wanting.

Dentition: i. $\frac{4}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{2-2}{3-3}$. The incisors small and rather wide apart from each other, the molars very small and weak with low crowns, the first upper premolar scarcely inferior in size to the second.

But a single species is known.

143. **Carponycteris minima.** *The small long-tongued Fruit-Bat.*

Pteropus minimus, Geoff. *Ann. Mus.* xv, p. 97 (1810).

Macroglossus minimus, Blyth, *J. A. S. B.* xxviii, p. 203; *id. Cat.* p. 21; *id. Man. Birds Burma*, p. 15; *Dobson, J. A. S. B.* xlii, pt. 2, p. 205, pl. xiv, fig. 11 (ear); *id. Mon. As. Chir.* p. 34; *id. Cat. Chir. B. M.* p. 96; *Anderson, Cat.* p. 107.

Ears rather longer than from the eye to the nostril, naked, rounded at the end, the outer margin with a small pointed basal lobe. Nostrils not prominent. Lower jaw projecting slightly beyond the upper. Eyes large. Interorbital membrane very narrow. Fur long.



Fig 78.—Ear of *C. minima*. (Dobson, Mon. As. Chir.)

Colour light brown, more or less rufous above, rather paler and grayer below.

Dimensions of an adult female: head and body 2·3 inches, ear 0·6, forearm 1·35. A skull measures 1·05 in total length and 0·6 in zygomatic breadth. This is the smallest of all known fruit-bats.

Distribution. Common in the warm valleys of Sikhim and extending thence through Burma to the Malay Archipelago and North and West Australia.

Habits. This small fruit-bat remains suspended to branches of trees during the day, and is occasionally found in old houses and sheds. It lives on fruit of every description.

Genus **EONYCTERIS**, Dobson (1873).

Muzzle long; nostrils not projecting, a shallow furrow between them, and a narrow vertical groove across the middle of the upper lip, which is naked throughout the area below the nostrils and the space between them. Index finger without a claw; metacarpal bone of the middle finger as long as the index finger. Wing from the side of the hairy back and from the base of the first toe. Tail short, distinct, the base contained in the narrow interfemoral membrane. Tongue very long and armed with long recurved papillæ.

Dentition: i. $\frac{4}{1}$, c. $\frac{1-1}{1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{2-2}{3-3}$. First upper premolar minute. Incisors small, subdistant, and molars small, scarcely elevated above the gum, as in *Carponycteris*.

A single species is known.

144. **Eonycteris spelæa**. Dobson's long-tongued Fruit-Bat.

Macroglossus spelæus, Dobson, *J. A. S. B.* xl, pt. 2, p. 261, pl. x, figs. 3, 4 (1871), xli, p. 334.

Eonycteris spelæa, Dobson, *J. A. S. B.* xlii, pt. 2, p. 204, pl. xiv, fig. 10 (ear); *id.* *Mon. As. Chir.* p. 33; *id.* *Cat. Chir. B. M.* p. 94; Blyth, *Mam. Birds Burma*, p. 15; Anderson, *Cat.* p. 106.

Ears moderately large, the tips but little rounded, a small projecting basal lobe to the outer margin. Thumb short, the base of the terminal phalanx included in the membrane. Fur short and thin. On each side of the anal orifice and a little behind it is a small subcutaneous glandular body. The tongue can be drawn nearly half an inch from the mouth in spirit specimens; the papillæ near the tip are very long.

Colour dark brown throughout, the lower portions sometimes a little paler.

Dimensions of an adult male: head and body 4·5 inches, tail 0·55, ear from orifice 0·75, forearm 2·85; total length of skull 1·45, zygomatic breadth 0·8.

Distribution. The types came from the Farm Caves, Moulmein. Specimens have also been recorded from Cambodia and Java (Dobson, P. Z. S. 1878, p. 877).

Habits. This appears to be a cavern inhabitant like *Xantharpyia amplexicaudata*. Nothing more is known of its habits, and the uses to which the peculiar extensile tongue of this genus and of *Carponycteris* is applied are unknown.



Fig. 79.—Ear of *E. spelæa*. (Dobson, Mon. As. Chir.)

Suborder MICROCHIROPTERA.

Family RHINOLOPHIDÆ.

A well-developed nose-leaf, consisting of foliaceous skin-processes around the nostrils, which are situated in a depression on the upper surface of the muzzle. Ears large, generally separated; no tragus. Two phalanges in addition to the metacarpal bone in the middle finger, index finger consisting only of the metacarpal. Premaxillary bones rudimentary and suspended from the nasal cartilages.

The upper incisors, two in number, are quite rudimentary; the first upper premolar minute; the molars well developed, with acute **W**-shaped cusps. The lower incisors are tricuspid. The milk-teeth are absorbed before birth.

The skull is large, the nasal bones much expanded. The females have two nipple-shaped prominences in front of the pubis. Tail distinct, produced to the posterior margin of the interfemoral membrane.

The very complicated nasal appendages consist of three parts, generally to be traced (fig. 80, p. 268). (1) The flat anterior nose-leaf, generally horseshoe-shaped, which more or less covers the sides and anterior extremity of the muzzle, and includes the nasal apertures, between or behind which (2) a median process or ridge, the central nose-leaf or *sella*, is placed; whilst more posteriorly on the face (3) the terminal or posterior nose-leaf arises vertically from the forehead, or extends backwards between the ears. The surface of the posterior nose-leaf is generally divided into cells by ridges, transversely arranged in *Rhinolophus*, longitudinally in *Hipposiderus*.

These are the most highly organized of insectivorous bats.

* These probably represent the inguinal teats of other Mammals. Cantor, J. A. S. B. xv, p. 182, records that a female *Hipposiderus*, during lactation, had one of these inguinal warts much larger than the other. The young are said to attach themselves to these prominences.

The greatly developed nose-leaf is evidently an organ of special perception akin to touch*; the variations in the form of this appendage are characteristic of the different species. The *Rhinolophidæ* are more nocturnal and less crepuscular than other insectivorous *Chiroptera*—a circumstance perhaps connected with the development of the nose-leaf.

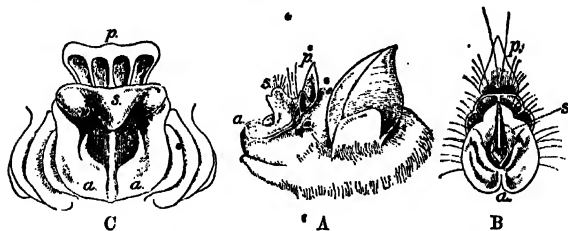


Fig. 80.—A. Head of *Rhinolophus affinis*, nat. size. B. Nose-leaf of *R. hipposiderus*, $\times \frac{1}{2}$. C. Nose-leaf of *Hipposiderus armiger*, $\times 2$. a. Anterior nose-leaf; p, posterior nose-leaf; s, sella.

The family is found throughout the temperate and tropical parts of the Eastern hemisphere and Australia, but not in Polynesia east of New Guinea, nor in America. It is divided into two subfamilies:—

- First toe with two, remaining toes with three joints each; a distinct antitragus separated by a notch from the outer margin of the ear. *Rhinolophinæ*.
 All the toes with two joints; no notch separating the antitragus from the outer margin of the ear. *Hipposiderinæ*.

It may be useful to repeat here that the measurements of bats, mostly taken, with other details, from Dobson's work, are from alcoholic specimens.

Subfamily RHINOLOPHINÆ.

Genus **RHINOLOPHUS**, Desm. (1803).

The only genus in the subfamily. The nose-leaf is large and perfect, all three parts (anterior, median, and posterior) being well developed; the anterior is horseshoe-shaped, usually with a deep incision in the middle in front, and rests flatly on the muzzle, the nostrils opening one inside each arm of the horseshoe; between and behind the nostrils the median nose-leaf or sella commences, the anterior portion being flat or recumbent on the nose, the continuation is then bent up and becomes an erect process, rising vertically from the face and consisting in most cases of two lamellæ at right angles to each other, the anterior transverse, the posterior longitudinal; the latter usually forms a connecting-process and

* Hutton observed that when the animals were disturbed the nose-leaves of several *Rhinolophidæ* were kept in a state of constant agitation.

joins the sella to the anterior portion of the posterior nose-leaf, which, in this genus, is always more or less triangular and terminates behind in a single point, whilst its surface in most species is divided into cells or hollows by transverse laminæ, often divided in the middle.

This genus may be distinguished by the form of the posterior nose-leaf and also by the deep notch at the base of the outer ear-margin, dividing off the large antitragus.

The wings are very large, the metacarpal bone of the fourth finger exceeds that of the second (or index) in length. Basioccipital at base of skull very narrow between the auditory bullæ.

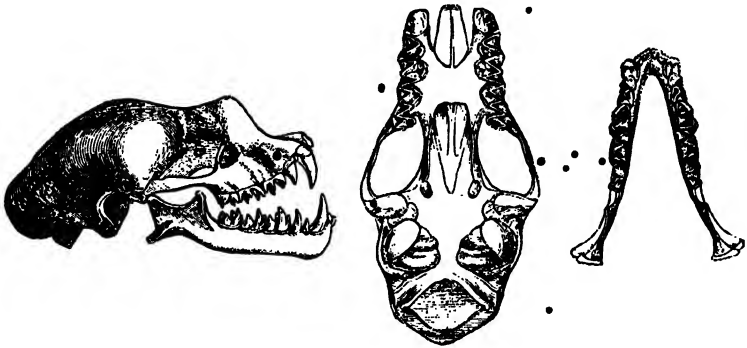


Fig. 81.—Skull of *Rhinolophus ferrum-equinum*, $\times 2$. (Blaßius, Säugeth. Deutschl.)

Dentition: $i. \frac{2}{3}$, $c. \frac{1-1}{1-1}$, $pm. \frac{2-2}{2-2}$, $m. \frac{3-3}{3-3}$. The first upper premolar minute, pointed, either in the tooth-row or else external to it between the closely approximated canine and second premolar, which is large. Second lower premolar generally minute and external to the tooth-row.

The genus *Rhinolophus* inhabits the temperate and tropical regions of the Eastern hemisphere, including Australia. No less than 13 species out of about 25 known at present are found within Indian limits.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Size large; forearm exceeding 2·5 inches . . . *R. luctus*, p. 270.
- B. Size moderate; forearm 1·75 to 2·5 inches
 - a. Posterior nose-leaf thickened around a large internal subcruciform hollow; forearm 1·85 *R. callophyllus*, p. 272.
 - b. Posterior leaf without large internal hollow.
 - a'. Second upper premolar close to canine, first premolar minute, external.
 - a''. Lower lip with a single median vertical groove; forearm 2·25 *R. ferrum-equinum*, [p. 278.
 - b''. Lower lip with 3 grooves; forearm 2·25 *R. tragatus*, p. 279.

- b'. Second upper premolar separated from canine by a space in which the small first premolar is placed.
- a''. Erect transverse process of sella with wing-like lateral expansions above nostrils; forearm 2 *R. trifoliatu*s, p. 272.
- b''. No lateral expansions to erect process of sella.
- a³. Anterior recumbent process of sella expanded, cup-shaped; erect transverse process much higher than posterior longitudinal buttress; forearm 2.25 *R. mitratus*, p. 273.
- b³. Anterior recumbent process of sella not expanded.
- a⁴. Transverse and longitudinal erect processes of sella equal in height; forearm 2.2 *R. pearsoni*, p. 273.
- b⁴. Longitudinal (posterior) process the higher.
- ° a. Recumbent process of sella broader than erect transverse process.
- a'. Margins of posterior nose-leaf concave; forearm 2.1 *R. affinis*, p. 274.
- β'. Margins of posterior leaf straight; forearm 2.05 *R. andamanensis*, [p. 275.]
- β. Recumbent process and erect transverse processes the same width; forearm 2 *R. petersi*, p. 275.
- C. Size small; forearm less than 1.75 inches.
- a. Ears very large, longer than the head; forearm 1.6 *R. macrotis*, p. 276.
- b. Ears shorter than the head.
- a'. Lower lip with three vertical grooves; forearm 1.45 *R. minor*, p. 276.
- b'. Lower lip with a single vertical groove; forearm 1.5 *R. hipposiderus*, p. 277.

145. *Rhinolophus luctus*. *The great Eastern Horseshoe-Bat*.

Rhinolophus luctus, *Temm. Mon. Mam.* ii, p. 24, pl. 30 (1835); *Hutton, P. Z. S.* 1872, p. 694; *Blyth, Mam. Birds Burma*, p. 19; *Dobson, Mon. As. Chir.* p. 39; *id. Cat. Chir. B. M.* p. 105; *Anderson, Cat.* p. 107; *Scully, J. A. S. B.* lvi, pt. 2, p. 240.

Rhinolophus perniger, *Hodys, J. A. S. B.* xii, p. 414; *Blyth, J. A. S. B.* xiii, p. 484; *id. Cat.* p. 23; *Jerdon, Mam.* p. 23.

This is the largest known species of the genus. The ears are very large, the tips acuminate and bluntly pointed, the outer margin concave below the tip and divided from the large and long antitragus by a deep re-entering angular notch.

Nose-leaf greatly developed and peculiar. The anterior leaf very large, projecting over the lip in front and at the sides, deeply incised in the middle. Sella expanded on each side of the base of the erect process into a rounded flat disk, one above each nostril. The transverse erect process is much higher than the short longitudinal posterior buttress, the free margin of the latter is rounded.

The posterior nose-leaf is long, it terminates in an acuminate blunt point between the ears, and its surface is complicated, being crossed by a flat diamond-shaped lamella above and by another lamella below.



Fig. 82.—Head of *Rhinolophus lucius*. (From Guide to the Galleries of Mammalia, British Museum.)

Lower lip divided in the middle by a single deep groove. Wing-membrane greatly developed and attached to the base of the first or outer toe; interfemoral membrane large, projecting behind and terminating in a point at the tip of the tail, which does not extend outside the membrane. Fur of body very long and dense, soft and slightly curly. Premolars as in *R. caelophyllus*.

Colour of the fur usually jet-black with ashy tips to the hairs, occasionally, it is said, reddish brown.

Dimensions of a large Himalayan specimen in alcohol: head and body 3.55 inches, tail 2.6, ear from head outside 1.25, forearm 2.95. Specimens from Southern India and Ceylon are rather smaller. The forearm in a series of specimens varies from 2.6 to 3 inches in length.

Distribution. The Himalayas at moderate elevations, the hill-ranges of Southern India and Ceylon, Burma, the Malay Peninsula and Archipelago, extending to Borneo and the Philippines. This bat appears to be restricted to the highlands of the countries inhabited.

Habits. Hodgson, in his original description of *R. perniger*, stated that it was shy, keeping to the forests and never approaching houses or cultivation; but Hutton, to whom we are indebted for a fuller account of the animal's habits, says that at Mussoorie he had taken specimens "hanging from the roof of an outhouse in which rabbits and firewood were kept, the bat looking, with its ample black wings folded round it as a cloak, somewhat like a large black cocoon."

Captain Hutton adds:—"This fine species commences its flight rather early in the evening, and does not soar high, like the smaller bats in general, but remains below at about twenty or thirty feet from the ground, wheeling with a somewhat heavy and noiseless flight around buildings and large trees in search of small beetles and other insects." . . . "This species appears usually to dwell in pairs, and does not associate in communities like some of the smaller *Rhinolophi*—though, in a large cavern, affording ample room for them to hang apart, several pairs may sometimes be found.

I have taken them from the roofs of outhouses, and in wide caves in limestone-rocks, but they appear to fly only during the warmer months of summer, remaining (at least such is the case at Mussoorie) in a semitorpid state during the winter."

146. *Rhinolophus cœlophyllus*. *The crescent Horseshoe-Bat.*

Rhinolophus cœlophyllus, *Peters*, *P. Z. S.* 1866, p. 426, pl. xxxv
Blyth, *Mam. Birds Burma*, p. 19; *Dobson*, *Mon. As. Chir.*
p. 53; *id. Cat. Chir. B. M.* p. 104, pl. vii, fig. 1 (nose-leaf); *Anderson*, *An. Zool. Res.* p. 96; *id. Cat.* p. 107.

Ears large, with narrow acute tips directed outwards, outer margin concave below the tip, a deep re-entering angle between descending portion of the outer margin and the large antitragus.

Anterior nose-leaf well developed. Median leaf or sella expanded in front, covering the nostrils; the transverse erect process narrow, and the longitudinal erect crest thicker and higher than usual and the same height as the transverse process; the upper edge of the longitudinal process rounded, the posterior termination in a deep hairy suberuciform hollow, which occupies the middle of the posterior leaf. This latter is thick, pointed behind, nearly triangular in outline, the surface covered with long hairs. The lower lip divided by three grooves.

The wings are from the ankles or from just above them. Interfemoral membrane concave or straight behind; tip of the tail projecting. Second upper premolar separated from the canine by a space, in the middle of which stands the small first premolar; the second lower premolar minute and external to the tooth-row.

Colour of fur brown above, pale brownish white below, the hairs above are white at the base, brown at the extremity.

Dimensions. Length of head and body 2 inches, tail 0·8, ear outside from the head 0·6, forearm 1·85.

Distribution. Hitherto only found in Burma. This species has been procured in the Salween valley near Moulmein by Captain A. C. Beavan, and at Tsagain in Upper Burma by Dr. J. Anderson.

Nothing is known of the habits. The nose-leaf differs from that of any other species.

147. *Rhinolophus trifolius*. *The trefoil Horseshoe-Bat.*

Rhinolophus trifolius, *Temm. Mon. Mam.* ii, p. 27, pl. 31 (1835);
Dobson, *Mon. As. Chir.* p. 41; *id. Cat. Chir. B. M.* p. 106; *Anderson*, *Cat.* p. 108.

Very similar to *R. luctus* in structure and even in the colour and length of the fur, but distinguished by its smaller size, by the erect transverse process of the sella being narrower above, and by the shape of the interfemoral membrane, the posterior margin of which is straight, with the extreme tip of the tail projecting. The specimens in the British Museum are from Borneo and are reddish brown in colour.

Dimensions. Head and body 2·3 inches long, tail 1·3, ear from head outside 0·9, forearm 2.

Distribution. A specimen from Assam, obtained by Mr. Peal, is in the Indian Museum; two others were obtained at Mergui by Mr. Hume; other localities recorded are India (eastern coast), Java, and Borneo.

148. *Rhinolophus mitratus*. *The mitred Horseshoe-Bat.*

Rhinolophus mitratus, *Blyth, J. A. S. B.* xiii, p. 483 (1844), xxii, p. 409, footnote; *id. Cat.* p. 23; *Jerdon, Mam.* p. 24; *Dobson, Mon. As. Chir.* p. 42; *id. Cat. Chir. B. M.* p. 107; *Anderson, Cat.* p. 108.

Ears large, pointed, outer margin very slightly convex, divided from the large antitragus by a shallow angular notch.

Anterior nose-leaf moderately developed; sella formed in front of two lappets, one over each nostril, together forming a cup-shaped depression, and behind of a small, erect, transverse process and of a still smaller and less elevated longitudinal lamella. Posterior nose-leaf subequilaterally triangular, sharply pointed. Lower lip with a single groove. Fur soft and rather long.

Colour of the fur rich light brown above, paler towards the base; below, the colour is much paler and the hair shorter.

Dimensions. Head and body 2·4 inches long, tail 1·6, ear (anteriorly) 1, forearm 2·25. Another specimen was smaller.

Distribution. Chybassa, S.W. Bengal (*Tickell*); Darjiling (*Dr. G. King*). Apparently rare.

149. *Rhinolophus pearsoni*. *Pearson's Horseshoe-Bat.*

Rhinolophus pearsoni, *Horsfield, Cat.* p. 33 (1851); *Blyth, J. A. S. B.* xxii, p. 409; *id. Cat.* p. 24; *Jerdon, Mam.* p. 25; *Dobson, Mon. As. Chir.* p. 43; *id. Cat. Chir. B. M.* p. 108; *Anderson, An. Zool. Res.* p. 95, pl. iv, fig. 1; *id. Cat.* p. 109.

Rhinolophus larvatus, *M.-F. de Rech. Mam.* p. 248, pl. xxxvii a, fig. 1, pl. xxxvii c, fig. 1.

Rhinolophus yunnanensis, *Dobson, J. A. S. B.* xli, pt. 2, p. 336.

Ears large, acutely pointed; outer margin concave, separated at the base from the large antitragus by a deep angular notch.

Anterior nose-leaf large, concealing the upper lip when viewed from above; sella in front, between the nostrils, of moderate breadth, having a raised longitudinal rib in the middle; the erect portion at first the same breadth, then suddenly narrowing and rounded off above; the posterior longitudinal buttress-like lamella of the same height, with a rounded upper margin; posterior leaf subequilaterally triangular with straight sides. Lower lip with a single groove.

Wings very wide, wing-membrane from the ankles; posterior free margin of interfemoral membrane nearly straight, the extreme tip of the tail protruding. Fur very long, dense and soft.

Colour dark brown to light chestnut, lower parts sometimes greyer.

Dimensions. Head and body 2·7 inches, tail 0·9, forearm 2·2, ear from head outside 0·8.

Distribution. The Himalayas (Mussoorie, Darjiling) and their extension in Eastern Tibet; also the Assam ranges south of the Brahmaputra (Khäsi and Gäro hills), the Lushai hills, and Yunnan.

150. *Rhinolophus affinis*. *The allied Horseshoe-Bat.*

Rhinolophus affinis, *Horsfield, Res. Java* (1824); ? *Cantor, J. A. S. B.* xv, p. 181; *Blyth, J. A. S. B.* xxi, p. 346; *id. Cat.* p. 24; *id. Mam. Birds Burma*, p. 20; *Jerdon, Mam.* p. 25; *Hutton, P. Z. S.* 1872, p. 696; *Dobson, Mon. As. Chir.* p. 47; *id. Cat. Chir. B. M.* p. 112; *Anderson, Cat.* p. 109; *Scully, J. A. S. B.* lvi, pt. 2, p. 242; *W. Blanford, J. A. S. B.* lvii, pt. 2, p. 261.

Rhinolophus rouxii, *Temm. Mon. Mam.* ii. p. 30 *b* (1835); *Blyth, U. cc.*; *Jerdon, l. c.*; *Hutton, l. c.* p. 697.

Rhinolophus rubidus, *R. cinerascens*, and *R. rammanika*, *Kelaart, Prod.* pp. 13, 14.

Rhinolophus rubidus (*errore fulvidus*) and *R. n. s.*, *Kelaart, apud Blyth, J. A. S. B.* xx, pp. 182-3.

Ears shorter than the head, sharply pointed, the outer* margin nearly straight, separated from the large antitragus by a moderately deep angular notch.

Anterior nose-leaf not quite large enough to conceal the muzzle when viewed from above, but very broad between its own outer and inner margins; sella moderately broad in front between the nostrils, the erect transverse portion of the same breadth throughout as that between the nostrils and rounded above, the longitudinal lamellar buttress-like process behind being of the same height or slightly higher, and with a rounded upper surface from which a few long hairs arise (fig. 80 A, p. 268); posterior leaf longer than broad, with concave margins, the tip elongate, acuminate, and rather blunt. Lower lip with three grooves.

Wing-membrane broad, variously attached to the tarsus, the ankle, or to the tibia above the ankle. Interfemoral membrane nearly straight behind or projecting angularly in the middle. Fur dense, soft, moderately long.

Colour very variable, from dark sooty brown or even dark ash to bright ferruginous or golden orange-brown, the hairs darker towards their extremities.

Dimensions. Head and body 2·3 inches long, tail 0·9, ear from head between ears 0·6, from base of inner margin 0·75, forearm 2·1, thumb 0·35.

Distribution. Peninsula of India from the Himalaya to Cape Comorin, ascending the Himalayas to 7000 feet (Mussoorie, Nepal, Darjiling), Ceylon, Burma, Cochin China, Sumatra, Java, and Borneo. Probably chiefly found in those parts of India that have a heavy rainfall; no specimens appear to be recorded from the Central Provinces, Coromandel Coast, N.W. Provinces, or Punjab. Dobson states that this bat inhabits the hill-tracts, but specimens are recorded by Blyth from Calcutta and Barrackpur, and from a cave near Colgong on the Ganges, and by Jerdon from Tellicherry.

Habits. The only account I can find is given by Hutton, who says:—"This species is early on the wing and may be seen in the evening twilight coursing slowly round the trees in search of insects, crunching the hard-winged beetles as it flies, with a sharp

crackling sound. It often flies so low as to be easily caught in a common butterfly net." Of *R. rouxi*, which, as Dobson has shown, is merely a lighter-coloured variety of *R. affinis*, Hutton remarks that at Mussoorie it makes its appearance as early as March, remaining inactive during the winter.

151. *Rhinolophus andamanensis*. *The Andaman Horseshoe-Bat.*

Rhinolophus andamanensis, Dobson, *J. A. S. B.* xli, pt. 2, p. 337 (1872); *id. Mon. As. Chir.* p. 46; *id. Cat. Chir. B. M.* p. 113; Anderson, *Cat.* p. 110.

Like *R. affinis* generally, but the anterior horseshoe-shaped membrane is very large, completely concealing the muzzle when viewed from above, as in *R. pearsoni*; the posterior terminal leaf is also much longer, produced backwards between the ears, and not concave on the sides as in *R. affinis*. The thumb is also much longer.

Colour of fur bright reddish brown above and below.

Dimensions. Length of an adult male preserved in alcohol: head and body 2·5 inches, tail 0·9, ear (from origin of outer margin) 0·85, forearm 2·05, thumb 0·45.

Distribution. A single specimen in the Indian Museum, Calcutta, was obtained on the Southern Andaman Island. The above description is copied from Dobson; I have not been able to examine a specimen.

152. *Rhinolophus petersi*. *Peters's Horseshoe-Bat.*

Rhinolophus petersii, Dobson, *J. A. S. B.* xli, pt. 2, p. 337 (1872); *id. Mon. As. Chir.* p. 49; *id. Cat. Chir. B. M.* p. 114; Hutton, *P. Z. S.* 1872, p. 700; Anderson, *Cat.* p. 110; W. Blanf. *J. A. S. B.* lvii, pt. 2, p. 261.

Ears moderate, subacutely pointed, outer margin concave, separated from the large antitragus by a moderately deep angular notch.

Anterior nose-leaf moderate, not nearly covering the muzzle. Sella of uniform breadth from between the nostrils to the rounded extremity of the erect transverse process; to this is attached posteriorly a longitudinal buttress-like lamella, the convex upper margin of which exceeds the transverse portion in height. Posterior leaf a little longer than broad, with concave sides and a subacute tip. Lower lip with three grooves.

Wing-membrane from the ankles; interfemoral membrane nearly square behind, the tip of the tail projecting slightly. Fur long and soft.

Colour of fur varying from greyish mouse-colour to brown, generally paler and greyer below.

Dimensions. Head and body 2·5 inches, tail 1, ear (from head between ears) 0·55, from base 0·75, forearm 2.

Distribution. Mussoorie (Hutton), and Coonoor, Nilgiri hills, South India (W. Davison).

Habits. At Mussoorie, where it is not common, Peters's leaf-nosed bat is said by Hutton to be found only during the warm summer months. It hides in caves &c. during the day and flies in the evening high and rapidly as a rule, though it is occasionally seen hunting over beds of flowers.

153. *Rhinolophus macrotis.* The large-eared Horseshoe-Bat.

Rhinolophus macrotis (Hodgson), *Blyth, J. A. S. B.* xiii, p. 485 (1844); *id. Cat.* p. 25; *Jerdon, Mam.* p. 26; *Hutton, P. Z. S.* 1872, p. 699; *Dobson, Mon. As. Chir.* p. 45; *id. Cat. Chir. B. M.* p. 110; *Anderson, Cat.* p. 109; *Scully, J. A. S. B.* lvi, pt. 2, p. 241.

Ears very large, their length exceeding that of the head, bluntly pointed; outer margin slightly concave.

Anterior nose-leaf large, covering the upper lip; sella broad, rounded in front, maintaining the same breadth throughout the erect transverse portion, which is rounded above, and supported behind by a longitudinal buttress-like connecting process, hairy, equal or slightly superior to the transverse process in height, obtusely rounded above; posterior leaf triangular, obtusely pointed, subequilateral. Lower lip with three grooves across it.



Fig. 83.—Head of *R. macrotis*. (Dobson, *Mon. As. Chir.*)

Wing-membrane from the ankles; interfemoral membrane generally pointed and projecting in the middle, but sometimes straight; the extreme tip of the tail free. Fur moderately long.

Colour sooty brown varying to light earthy brown (and probably to bright chestnut) above, paler and greyer below.

Dimensions. Head and body 1·7 inches long, tail 0·8, ear from crown of head 0·75 (from base 0·85), forearm 1·6. In fresh specimens the ear is an inch long according to Hutton and from nose to tail 2·5.

Distribution. Hitherto only recorded from two Himalayan localities, Nepal and Mussoorie. At the last-named locality one was captured at 5500 feet.

Habits. Hutton says of these bats, "They come out of caves in the earlier twilight hours, and may be seen flitting rapidly at some height in the air, chasing the small flies and beetles which abound during the rainy season."

154. *Rhinolophus minor.* The little Indian Horseshoe-Bat.

Rhinolophus minor, *Horsfield, Res. Java* (1824); *Blyth, J. A. S. B.* xxi, pp. 347 note, 361; *Hutton, P. Z. S.* 1872, p. 698; *Dobson, Mon. As. Chir.* p. 50; *id. Cat. Chir. B. M.* p. 114; *id. Report Brit. Assoc.* 1880, p. 175; *Anderson, Cat.* p. 110; *Scully, J. A. S. B.* lvi, pt. 2, p. 243; *W. Blanford, J. A. S. B.* lvii, pt. 2, p. 261.

? *Rhinolophus lepidus*, *Blyth, J. A. S. B.* xiii, p. 486 (1844).

Rhinolophus subbadius, *Blyth, J. A. S. B.* xiii, p. 486, xxi, pp. 347, 361; *id. Cat.* p. 25; *Jerdon, Mam.* p. 26, *nec Hodgson*.

Rhinolophus pusillus, *Dobson, P. A. S. B.* 1872, p. 155; *Blyth, Mam. Birds Burma*, p. 20, *nec Temminck*.

Rhinolophus garoensis, *Dobson, J. A. S. B.* xli, pt. 2, p. 387; *id. Mon. As. Chir.* p. 48; *id. Cat. Chir., B. M.* p. 115; *Anderson, Cat.* p. 110.

Ears a little shorter than the head, subacutely pointed, outer margin concave just below the tip.

Anterior nose-leaf deep from outer to inner margin, but not large enough to conceal the muzzle when viewed from above; sella somewhat broader in front, the erect transverse process a little narrower than that between the nostrils, and rounded off above, the longitudinal buttress-like lamella behind much higher than the transverse process, and pointed above (more pointed in some specimens than in others); posterior leaf longer than broad in general, and with the sides concave and the tip acuminate, but this is variable also, and in one variety (*R. garoensis*, fig. 84) the posterior leaf is almost an equilateral triangle with straight sides. Lower lip with three grooves.



Fig. 84.—Nose-leaf of *R. minor*, var. *garoensis*, (Dobson, *Mon. As. Chir.*)

Wings from the ankles. Interfemoral membrane straight or nearly so behind, but somewhat variable.

Fur moderately long.

The second lower premolar is sometimes in the tooth-row, more often, as in most other species, external, wedged in between the outer angles of the adjoining teeth.

Colour of fur light brown above, greyish brown below, varying in tint as usual.

Dimensions. Head and body 1·75 inches, tail 0·75, ear from crown of head 0·45, from base 0·55, forearm 1·45.

Distribution. The Himalayas (Mussoorie, Nepal), Gáro hills, the Wynaad and Malabar Coast, and probably the neighbourhood of Calcutta (*R. lepidus*), Burma, Siam, Sumatra, Java, Borneo, and Japan. Apparently rare in the Peninsula of India. The Himalayan and Gáro form is that with the triangular posterior nose-leaf, fig. 84 (*R. subbadius*, *Blyth*, or *garoensis*, *Dobson*).

155. *Rhinolophus hipposiderus*. *The lesser Horseshoe-Bat.*

Noctilio hipposideros, *Bechstein, Naturg. Deutschl.* edit. 2, i, p. 1194 (1801).

Rhinolophus hipposideros, *Dobson, Mon. As. Chir.* p. 52; *id. Cat. Chir. B. M.* p. 117; *Scully, P. Z. S.* 1881, p. 198.

Ears nearly as long as the head, very pointed, the outer margin deeply concave and separated from the large antitragus by a deep angular notch.

Anterior nose-leaf broad from the nostrils to the margin, but not concealing the muzzle; sella of moderate breadth where flat, the erect transverse portion gradually becoming narrower, rounded at top; the hinder longitudinal buttress-like lamella hairy, pointed, scarcely exceeding the transverse portion in height; posterior leaf longer than broad, with the sides slightly concave and the tip blunt (fig. 80 B, p. 268). Lower lip with a single groove.

Wings from the ankles; interfemoral membrane projecting angularly behind; extreme tip of the tail free.

Colour of fur light brown above, light greyish brown below. Young animals often darker.

Dimensions. Head and body 1·55 inches, tail 1·15, ear from origin of outer margin 0·6, from head between ears 0·55, forearm 1·5.

Distribution. In India this species has only been observed in Gilgit, where Scully found it fairly common in the warm valleys 4000 to 6000 feet above sea-level, during the summer months. It is also met with throughout the greater part of the Palearctic region, extending in Western Europe as far north as the shores of the Baltic.

Habits. During the day *R. hipposiderus* hides in caves, ruined buildings, outhouses &c., often in large numbers. It usually appears abroad about dusk, and according to Scully has a powerful and long sustained flight, but Blasius says its flight is rather irregular and fluttering. It flies generally higher in the air than *R. ferrum-equinum*, and is more frequently found away from dense tree-growth.

156. *Rhinolophus ferrum-equinum.* *The greater Horseshoe-Bat.*

Vespertilio ferrum-equinum, Schreb. *Säugeth.* i, p. 174, pl. lxi (1775).

Rhinolophus ferrum-equinum, Dobson, *Mon. As. Chir.* p. 53; *id. Cat. Chir. B. M.* p. 119, partim; Scully, *P. Z. S.* 1881, p. 199.

Ears nearly equal to the head in length, sharply pointed; the outer margin concave just below the tip and separated below by a shallow obtuse notch from the moderately large antitragus.

Nose-leaf rather small, anterior horseshoe broad from nostrils to outer margin, but not nearly covering the muzzle; sella small, erect transverse process narrow, with the sides slightly concave and the top rounded; longitudinal buttress-like lamina behind a little higher than the transverse process, hairy and obtusely pointed; posterior leaf longer than broad, with concave sides and a blunt tip. Lower lip with a single groove.

Wings from the ankles, interfemoral membrane projecting slightly in the middle behind; tip of the tail free.

The second upper premolar is close to the canine; the first premolar minute and external to the tooth-row; second lower premolar very minute, often not to be detected, lying in the outer angle between the closely approximate first and third premolars.

Colour of fur above reddish brown with a greyish tinge, beneath pale grey, almost white.

Dimensions. Head and body 2·35 inches, tail 1·55, ear $\frac{1}{2}$ from anterior base 0·9, from crown of head 0·75, forearm 2·25.

Distribution. Europe, Africa, and Asia north of the Himalayas, not ranging quite so far north as *R. hipposiderus*, but extending to the Cape of Good Hope. Within Indian limits this species has, like *R. hipposiderus*, only been found in Gilgit.

Habits. In the day the greater horseshoe-bat hides in dry caves, outhouses, ruins, and similar places, like so many of the other *Rhinolophi*; it appears rather late in the evening, flies low, and keeps much about trees. Its flight is less well sustained than that of *R. hipposiderus*. Scully found it very common in the low hot valleys of Gilgit from about the middle of April to the end of September, its vertical range being from about 4500 to 5500 feet.

157. *Rhinolophus tragatus*. *Hodgson's Horseshoe-Bat.*

Rhinolophus tragatus, *Hodgson, J. A. S. B.* iv, p. 690 (1835); *Blyth, J. A. S. B.* xiii, p. 484, xxii, p. 409, note; *id. Cat. p.* 24; *Jerdon, Mam. p.* 24; *W. Blanford, J. A. S. B.* lvii, pt. 2, p. 263.

Rhinolophus ferrum-equinum, *Dobson, P. A. S. B.* 1872, p. 208; *id. Mon. As. Chir. p.* 53; *id. Cat. Chir. B. M. p.* 119, partim; *Hutton, P. Z. S.* 1872, p. 698; *Anderson, Cat. p.* 111, partim *Scully, J. A. S. B.* lvi, pt. 2, p. 245; *nec Schreber.*

? *Rhinolophus brevitarus**, *Blyth, Cat. p.* 24, no description.

This species, which was by Dobson united to *R. ferrum-equinum*, resembles that bat closely in all characters except in having three grooves instead of one on the lower lip, as was observed by Blyth (*J. A. S. B.* xxii, p. 409). The nose-leaf is considerably broader as a rule, but there is some variation in this respect. In structure, with the above exception, colour and dimensions the characters of the last species apply to the present. Pubic teats greatly developed.

Distribution. The Himalayas from Mussoorie to Sikhim, and from a moderate elevation to 6000 or 7000 feet.

Habits. According to Hodgson this bat emerges from the rock-cavities in which it passes the day sooner in the evening than the *Vespertilionidæ* and always in considerable numbers. It is not migratory and does not hibernate. It breeds once in the year towards the close of summer and produces two young.

The only Asiatic *Rhinolophi* not found in India are two Western forms, *R. euryale* and *R. blasii*, *R. acuminatus* known only from Java, and two Philippine species. The remaining members of the genus are African or Australian, mostly the former.

* Founded on a dried specimen in bad condition, perhaps referable to *R. minor* (see Dobson, *Cat. As. Chir. p.* 197, no. 197).

Subfamily HIPPOSIDERINÆ.

This subfamily is distinguished from the *Rhinolophinæ* by having only two phalanges in all the toes (a character exhibited by only one other bat, the American *Thyroptera tricolor*), by the absence of a notch in the outer border of the ear, and consequently by having no distinct antitragus, and by the shape of the nose-leaf, the posterior portion of which is not triangular. Another peculiarity, unknown amongst other Chiroptera, is the existence of a second pair of large foramina in the pelvis, besides the usual thyroid or obturator foramina. The second foramen is preacetabular, and formed by the ileo-pectineal spine being united by a bony isthmus with a process derived from the antero-inferior surface of the ilium. This character, Dobson points out, greatly strengthens the pelvis, which is remarkably weak in bats, but it is not known whether any peculiarity in the habits of *Hipposiderus* and its allies corresponds to the increased strength of the pelvic girdle.

Two genera of the *Hipposiderinæ* occur in India and a third is known from Persia and may probably occur in Baluchistan. These genera may thus be distinguished:—

- | | |
|--|---------------|
| A. No flat expanded lamina between the nostrils; a transverse swollen bar behind them. | |
| a. Anterior nose-leaf or horseshoe not divided in the middle | HIPPOSIDERUS. |
| b. Anterior nose-leaf divided into two distinct lappets | CÆLOPS. |
| B. A flat expanded lamina between the nostrils, no transverse bar behind them | TRIÆNOPS. |



Fig. 85.—Head of *Triænops persicus*, $\times 2$. (Dobson, Mon. As. Chir.)

Triænops persicus has been found in Persia at Shiráz, and in East Africa. Should it occur within Indian limits, the accompanying woodcut will enable it to be easily recognized. It is a pale buff bat, with the forearm, 2 inches long.

Genus **HIPPOSIDERUS**, Gray (1831).

Syn. *Phyllorhina*, Bonaparte (1837), *neq* Leach; *Asellia*, &c., Gray.

The nose-leaf more or less square or oblong in form, and complicated, consisting of three portions—anterior, median (or *sella*), and posterior; the anterior horseshoe-shaped or semicircular as in *Rhinolophus*, resting flatly on the muzzle, but without any deep incision, and, in most species, without even a notch, in front. The nostrils open freely in the middle of the horseshoe, each is generally partly or wholly surrounded by a lamina, and there is a more or less pronounced longitudinal ridge between them. On each side of the horseshoe there are, in several species, supplementary leaflets forming a fringe. The *sella* does not come forward between the nostrils; it is a prominent transverse bar behind them and divides the horseshoe in front from the posterior leaf behind. The latter is never triangular: the hinder margin is simply rounded in most species, tricuspid in a few; it is usually bent forward over the front surface of the leaf, which is generally divided into shallow cells (as a rule four in number) by longitudinal (antero-posterior) ribs (fig. 80 C, p. 268). Behind the nose-leaf there is, in the males of several species, and to a smaller degree in females, a large pore, being the orifice of a glandular sac, which the animal can evert at pleasure like the finger of a glove; the opening is marked by a pencil of stiff hairs. At the sides of the posterior leaf and above the eyes are one or more wart-like prominences, sometimes bearing pores; in some species these prominences form a kind of fringe to the posterior nose-leaf.

Dentition: i. $\frac{2}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. First upper premolar minute, blunt, in the outer angle between the canine and second premolar, rarely deciduous except in *H. tridens* and one other species (not Indian), in which adults have pm. $\frac{1-1}{2-2}$.

I have explained at full length elsewhere (P. Z. S. 1887, p. 637) the reasons that have induced me to employ the name *Hipposiderus* for this genus instead of *Phyllorhina*, which is adopted by Dobson and others.

The genus *Hipposiderus* ranges throughout the tropical and sub-tropical parts of Asia (including the Malay Archipelago), Africa, and Australasia. It is not Palearctic like *Rhinolophus*, nor is it by any means restricted in India to the hills and highlands. The Indian species are not quite so numerous as those of *Rhinolophus*, but they are more generally diffused.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Size large, forearm exceeding 3 inches.

a. A large frontal glandular sac; posterior leaf narrower than horseshoe; forearm about 3.5

H. armiger, p. 283.

b. No frontal sac; posterior leaf not narrower than horseshoe; forearm about 3.4

H. diadema, p. 284.

B. Size small, forearm less than 3 inches.

- a. Posterior margin of nose-leaf terminating in three sharp points; forearm 1·75 *H. tridens*, p. 282.
- b. Posterior margin of nose-leaf rounded.
- a'. Three supplementary leaflets on each side of the horseshoe.
- a''. Surface of posterior leaf divided into 2 cells; forearm 2·6 *H. nicoburensis*, p. 286.
- b''. Surface of posterior leaf divided into 4 cells.
- a. Posterior leaf narrower than horseshoe; forearm 2·45 *H. leptophyllum*, p. 284.
- β. Posterior leaf as wide as horseshoe or wider.
- a'. Hinder margin of interfemoral membrane straight; forearm 2 *H. speoris*, p. 287.
- β'. Hinder margin of interfemoral membrane forming a salient angle; forearm 2·25 *H. larvatus*, p. 288.
- b'. Two supplementary leaflets; forearm 1·75 *H. galeritus*, p. 287.
- c'. No supplementary leaflets.
- a''. Ears laid forward extend to muzzle; forearm 1·55 *H. bicolor*, p. 289.
- b''. Ears do not extend to muzzle; forearm 1·4 *H. amboinensis*, p. 290.

158. *Hipposiderus tridens*. *The trident leaf-nosed Bat*.

- *Rhinolophus tridens*, Geoffroy, *Descr. de l'Egypte*, ii, p. 130 (1813).
Phyllorhina tridens, Dobson, *Cat. Chir. B. M.* p. 131.
Phyllorhina tridens, var. *murraiana*, Anderson, *Cat.* p. 113; Murray, *Vert. Zool. Sind*, p. 6, pl. i, fig. 2 (head).

Ears of moderate size, tips pointed, outer margin slightly concave above, then convex, inner margin very convex. Anterior nose-leaf or horseshoe semicircular, having, on each side, two secondary leaflets; sella prominent, trilobate; posterior leaf having the surface divided into four cells by three longitudinal ribs, and terminating above on the forehead in three thickened and pointed projections.

Wings from the lower third of the tibia; interfemoral membrane short, square behind; the last two vertebræ of the tail and sometimes part of the penultimate free. First minute upper premolar deciduous.

Colour of fur above greyish brown, the basal portion paler, sometimes white; beneath wholly yellowish white or pure white.

Dimensions of a Karáchi specimen: head and body 2·3 inches, tail 1, ear from origin of outer margin 0·75, forearm 2·1. African specimens are smaller.

Distribution. Sind; procured in Karáchi by Mr. J. Murray, who observed it in April about dusk in large numbers. Also found in Southern Persia, Mesopotamia, Egypt, and Zanzibar.

The variety called *murraiana* by Anderson is larger, its ears are somewhat shorter, broader, and less pointed, and its wing and interfemoral membranes are attached rather lower on the tibia. One or two other small differences are noted, but they are not of much importance.

159. *Hipposiderus armiger*. *The great Himalayan leaf-nosed Bat.*

Rhinolophus armiger, *Hodgson, J. A. S. B.* iv, p. 699 (1835).

Hipposideros armiger, *Blyth, J. A. S. B.* xiii, p. 488; *id. Cat.* p. 25; *Jerdon, Mam.* p. 27.

Hipposideros diadema, *Cantor, J. A. S. B.* xv, p. 181, *nec Geoffroy*.

Phyllorhina armigera, *Hutton, P. Z. S.* 1872, p. 700; *Dobson, P. Z. S.* 1873, p. 242; *id. J. A. S. B.* xliii, pt. 2, p. 234; *id. Mon. As. Chir.* p. 64; *id. Cat. Chir. B. M.* p. 135; *Anderson, Cat.* p. 114; *Scully, J. A. S. B.* lvi, pt. 2, p. 245.*

Ears moderate, tips blunt, outer margin slightly concave near the tip, then moderately convex, inner margin convex.

Nose-leaf large; anterior leaf shield-shaped, with four supplementary leaves on each side; sella trilobate, posterior leaf narrower than the anterior (exclusive of the lateral leaflets), the surface divided into four cells as usual, the hinder margin sinuate, slightly elevated at the centre and at both ends (fig. 80 C, p. 268). There is a well-marked frontal sac with a transverse opening; this sac is much developed in old males, in which it forms the apex of a swollen fleshy naked area bordering the posterior leaf behind and on the sides. In females there are only wart-like elevations on each side above the eyes.

Wing-membrane from the tibia a little above the ankle; interfemoral membrane projecting triangularly behind; extreme tip of tail free. Fur soft and thick.

Colour of fur varying from light to dark brown, generally dark brown, a little paler below. The hairs of the back, in some cases at all events, are brown at the base, then whitish, and darker brown at the tips.

Dimensions of a large male: head and body 4.2 inches long, tail 2.1, ear from origin of outer margin 1.15, from crown of head 0.95, forearm 3.8. In a female the head and body are 3.5, tail 2.2, forearm 3.3 inches. This is the largest of Indian *Rhinolophidae* and is only exceeded in size by one species of the family, the African *H. commersoni*.

Distribution. Himalayas (Mussoorie, Nepal, Sikhim), Khási hills, also Penang, Cochin China, and China. Ceylon is given by Dobson as a locality, but I am unable to discover the authority*. This bat probably inhabits Burma.

* Perhaps Blyth, *J. A. S. B.* xxi, p. 346, where *H. lankadiva*, Kelaart, was identified with *H. armiger*. But the specimens referred to by Blyth in the passage have been identified by Dobson with *H. diadema*, *Mon. As. Chir.* p. 200.

Habits. Hutton describes this species as not enveloping itself so completely in its wings, when suspended by its feet, as *Rhinolophus*, and as keeping the tail and interfemoral membrane turned up over the lower part of the back. He observed specimens at Mussoorie in a loft, whence they issued before dark, or, during cloudy and misty weather, before sunset, and flew with a slow steady flight about the trees, capturing beetles and *Cicadæ*. The latter, as Hutton remarks, are peculiarly noisy just after sunset in the rainy season and thus are easily found by the bats.

When this bat is captured alive, Hutton says, the large ears are kept in a constant state of rapid tremulous motion, and the animal emits a low purring sound, which becomes a sharp squeak under the influence of alarm or irritation. The tremulous motion of the ears is common to the majority of insectivorous bats.

According to Hodgson *H. armiger* breeds once a year and produces two young towards the close of summer.

160. *Hipposiderus leptophyllum*. *Dobson's leaf-nosed Bat.*

Phyllorhina leptophylla, Dobson, *J. A. S. B.* xliii, pt. 2, p. 234 (1874); *id. Mon. As. Chir.* p. 66; *id. Cat. Chir. B. M.* p. 136; *Anderson, Cat.* p. 114.

"Ears rather large, broad and triangular, with subacute tips, the outer margin slightly concave beneath the tip. The upper (posterior) transverse nose-leaf small, upper edge simple, narrower than the horseshoe portion, thin, the three vertical folds in front faintly discernible at the base only; the horseshoe with a small incision in the centre of its front free edge; frontal pore small, placed at some distance behind the transverse nose-leaf.

"Wing-membranes from the tibia, a short distance above the ankle; interfemoral membrane triangular, the extremity of the tail projecting.

"Fur and integuments dark throughout.

"Distinguished from *H. armiger* by its considerably smaller size, by the upper transverse nose-leaf being simple, not lobed above as in that species, and by the incised front edge of the horseshoe, which in *H. armiger* is invariably plain.

"Length (of an adult male preserved in alcohol): head and body 2.5 inches, tail 1.65, ear (from origin of outer margin) 0.9, forearm 2.45." (*Dobson.*)

Distribution. The Khási hills, where a single specimen was obtained by Col. H. Godwin-Austen. No other is known. The above is copied from Dobson's description.

161. *Hipposiderus diadema*. *The large Malay leaf-nosed Bat.*

Rhinolophus diadema, Geoffroy, *Ann. Mus. Hist. Nat.* xx, p. 263 (1813).

Rhinolophus nobilis, Horsfield, *Res. Java* (1824).

Hipposideros nobilis, *Cantor, J. A. S. B.* xv, p. 182; *Blyth, J. A. S. B.* xxi, p. 346; *id. Cat.* p. 26.

Hipposideros lankadiva, *Kelaart, Prod.* p. 19; *Blyth, J. A. S. B.* xx, p. 183; *id. Cat.* p. 26.

Phyllorhina masoni, *Dobson, J. A. S. B.* xli, pt. 2, p. 338.

Phyllorhina diadema, *Dobson, Mon. As. Chir.* p. 61; *id. Cat. Chir. B. M.* p. 137; *Blyth, Mam. Birds Burma*, p. 20; *Anderson, Cat.* p. 115.

Hipposiderus diadema, *W. Blanford, J. A. S. B.* lvii, pt. 2, p. 263.

Ears pointed, outer margin nearly or quite straight below the tip.

Anterior nose-leaf about the same width on the face as the posterior, almost semicircular, with three supplementary leaflets on each side. Sella with a prominent ridge in the middle. Posterior leaf with a rounded free margin, slightly prominent and thickened

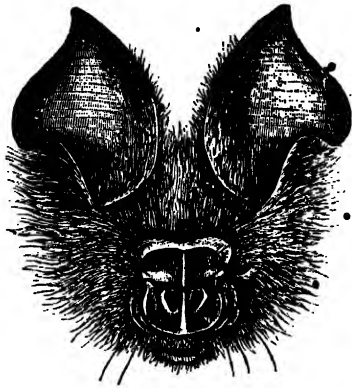


Fig. 86.—Head of *Hipposiderus diadema*, var. (*H. masoni*). (*Dobson, Mon. As. Chir.*)

in the middle, the front surface divided into four cells by longitudinal ribs as usual. No frontal pore. Wings from the ankles; interfemoral membrane large, projecting triangularly behind; last caudal vertebra free.

Colour. Fur various shades of brown above, paler below. The basal and terminal portions of the dorsal hair brown, intermediate parts paler, sometimes white.

Dimensions. Head and body 3·4 inches, tail 2·3, ear from the crown 0·9, forearm 3·4 (varying from 3 to 3·6).

Distribution. In the Indian Peninsula this species has been found by Mr. V. Ball at Udaipur, north-west of Sambalpur, Central Provinces, and by myself near Bhandara east of Nagpur; remains also occur fossil in the Kurnool caves (Pleistocene). Other localities are Ceylon, Sikhim, Moulmein, Penang, and most of the islands in the Malay Archipelago, also the Philippines.

A specimen (fig. 86) from Moulmein, which differs in having the posterior nose-leaf divided into two cells only and in having

a small bony process from the symphysis of the mandible, was separated by Dobson as *Phyllorhina masoni*; but in his British Museum Catalogue he states that the differences are probably merely individual peculiarities.

Habits. This species, like other members of the genus, haunts rocky caves, old tombs, and other buildings; Kelaart found it swarming in a tunnel cut through a rocky hill near Kandy.

162. *Hipposiderus nicobarensis*. 'The Nicobar leaf-nosed Bat.

Phyllorhina nicobarensis, Dobson, *J. A. S. B.* xl, p. 262, pl. xx, fig. 2 (1871); *id. Mon. As. Chir.* p. 63; *id. Cat. Chir. B. M.* p. 138; Anderson, *Cat.* p. 115.

"Ears large, acutely pointed, outer margin slightly concave beneath the tip; no frontal sac behind the nose-leaf; upper margin of the transverse leaf simple, forming an arc of a circle, folded back



Fig. 87.—Head of *Hipposiderus nicobarensis*. (Dobson, *Mon. As. Chir.*)

(? forward) and overhanging the concave front surface, which is divided into *two cells only* by a single central vertical ridge; in front the margin of the horseshoe has three small points.

"Wing-membrane from the base of the metatarsal bone of the outer toe; tail of six vertebrae, the last free.

"Fur above light brown at the base, then greyish brown, with light brown extremities; beneath pale brownish grey."

Dimensions. Head and body 3 inches, tail 1·7, ear from origin of outer margin 0·9, forearm 2·6.

Distribution. Nicobar Islands. The only specimen known was procured by Dr. Stoliczka and is preserved in the Indian Museum, Calcutta.

The above description is copied from Dobson; the form resembles *H. diadema*, but is distinguished by the posterior leaf being only divided into two cells, by the different attachment of the wing-membrane, and by much smaller size. From the figures it appears that there are three supplementary leaves on each side of the horseshoe, and the sella appears to have a prominent median ridge.

163. *Hipposiderus galeritus*. *Cantor's leaf-nosed Bat*.

Hipposideros galeritus, *Cantor, J. A. S. B.* xv, p. 183 (1846).

Phyllorhina brachyota, *Dobson, J. A. S. B.* xliii, pt. 2, p. 237.

Phyllorhina galerita, *Dobson, Mon. As. Chir.* p. 69; *id. Cat. Chir. B. M.* p. 141; *Anderson, Cat.* p. 116.

Ears comparatively short and broad, outer margin concave below the blunt tip, then convex, inner margin very convex.

Anterior nose-leaf well developed, extending almost to the end of the muzzle, and having two secondary leaflets on each side; sella broad, with a slightly prominent ridge in the middle; posterior leaf evenly rounded behind, the surface divided into four cells by longitudinal ribs. Frontal sac distinct in males, just behind the posterior leaf, very indistinct in females.

Thumb and foot small; wing from the metatarsus, between the ankle and the base of the toes; interfemoral membrane broad, projecting triangularly behind; tip of the tail free. Second upper premolar more distant from the canine than usual in this genus; first premolar minute.

Colour of fur deep reddish brown above, paler beneath, the fur on the shoulders and along the spine darkest. The dorsal hairs are light brown at the base, the terminal third dark brown, the extreme tips paler again. Bright ferruginous specimens also occur.

Dimensions. Head and body 2 inches, tail 1·4, ear from crown 0·4, forearm 1·75.

Distribution. This form appears to be very rare west of the Bay of Bengal; it has been found in Ceylon and at one locality in the Indian Peninsula, Lingasugúr, N.N.W. of Bellary. It has been recorded from Penang, Singapore, Java, and Borneo.

Dobson notices some variation in the size of the nose-leaf, length of the tail, and place of attachment of the wing-membrane.

164. *Hipposiderus speoris*. *Schneider's leaf-nosed Bat*.

Vespertilio speoris, *Schneider, Schreber, Säugth. Supp.* pl. 59 B; *Geoff. Ann. Mus.* xx, p. 261 (1813).

Rhinolophus dukhunensis, *Sykes, P. Z. S.* 1831, p. 99.

Rhinolophus speoris, *Elliot, Mud. Jour. L. S.* x, p. 98.

Hipposideros speoris, *Blyth, J. A. S. B.* xiii, p. 489, xxi, p. 347; *id. Cat.* p. 26; *Jerdon, Mam.* p. 27.

Hipposiderus speoris, *H. templetoni*, *H. aureus*, and *H. blythii*, *Kelaart, Prod.* pp. 17, 18, 20.

Phyllorhina speoris, *Dobson, Mon. As. Chir.* p. 67; *id. Cat. Chir. B. M.* p. 143; *Blyth, Mam. Birds Burma*, p. 21; *Anderson, An. Zool. Res.* p. 97; *id. Cat.* p. 116.

Ears broad, pointed, outer margin concave below the tip, then convex, and having a small spine-like projection about one third the distance from the base to the tip (in the same position as the notch in *Rhinolophus*); upper third of inner margin nearly straight, lower two thirds very convex.

Anterior nose-leaf not covering the end of the muzzle, having three supplementary leaflets on each side; sella broad; posterior leaf evenly rounded behind, the surface divided into four cells by longitudinal ridges. Frontal sac well developed. Wing-membranes from the tibia near the ankle. Interfemoral membrane short, square behind; the end of the tail projecting.

Colour of fur above brown, varying from bright golden-brown to mouse-colour, the hairs white at the base; below, the tint is similar but paler.

Dimensions. Head and body 2·4 inches, tail 0·85, ear from crown 0·5, forearm 2.

Distribution. Throughout the greater part of India, specimens having been obtained from Dehra Dun, from Chánda and other localities in the Deccan, and from several places in Southern India (Madras, Nellore, Trichinopoly, Travancore, &c.), where Jerdon says this bat is far from rare, inhabiting old buildings, wells, &c. It also appears to be common in Ceylon. It has been found at Prome in Burma, and has an extensive range in the Malay Archipelago.

As in so many other cases, nothing appears known of the habits of this common bat, except that it is found in caves and masonry-buildings, ruins, tombs, wells, &c.

165. *Hipposiderus larvatus*. Horsfield's leaf-nosed Bat.

Rhinolophus larvatus, vulgaris, deformis, and insignis, Horsfield, *Res. Java* (1824).

Hipposideros larvatus, Blyth, *J. A. S. B.* xiii, p. 488; *id. Cat.* p. 26.

Hipposideros vulgaris, Blyth, *J. A. S. B.* xiii, p. 488; Cantor, *J. A. S. B.* xv, p. 183.

Phyllorhina larvata, Dobson, *P. A. S. B.* 1872, p. 155; *id. J. A. S. B.* xliii, pt. 2, p. 235; *id. Mon. As. Chir.* p. 68; *id. Cat. Chir. B. M.* p. 145; Blyth, *Mam. Birds Burma*, p. 21; Anderson, *An. Zool. Res.* p. 97; *id. Cat.* p. 117.

Ears broad, pointed, outer margin concave below the tip, then convex; there is a slight thickening about one third the distance from the base, but no distinct projection as in *H. speoris*.

Anterior nose-leaf not covering the end of the muzzle and having three supplementary leaflets on each side; sella well developed, distinctly trilobed; posterior leaf rather broader than the horse-shoe, divided into four cells, hinder margin regularly rounded. A well-marked frontal sac in males, but much smaller in females. In some males the wart-like glandular prominences on each side of the posterior leaf are greatly developed, as in *H. armiger*. Wings from the ankle-joint, or from the tibia just above; interfemoral membrane projecting and triangular behind; extreme tip of tail free.

Colour of fur very variable, generally reddish brown, the base of the hairs paler.

Dimensions. Head and body 3 inches, tail 1·5, ear from crown 0·75, forearm 2·45.

Distribution. Assam, Sylhet, and throughout Burma, also Siam and Java.

This species is closely allied to *H. speoris*, but distinguished by larger size, proportionally larger ears, and by the posterior margin of the interfemoral membrane forming a salient angle, instead of being straight.

166. *Hipposiderus bicolor*. * *The bicoloured leaf-nosed Bat.*

Rhinolophus bicolor, Temminck, *Mon. Mam.* ii, p. 18 (1835-41).

Hipposideros fulvus and murinus, Gray, *Mag. Zool. Bot.* ii, p. 492 (1838); *Blyth, J. A. S. B.* xiii, p. 489, xxi, p. 347.

Rhinolophus murinus and fulgens, Elliot, *Mad. Jour. L. S.* x, p. 99.

? *Rhinolophus subbadius*, Hodgson, *J. A. S. B.* xiii, p. 486, *nec Blyth.*

Hipposideros murinus, Cantor, *J. A. S. B.* xv, p. 183.

Hipposideros ater, Templeton, *J. A. S. B.* xvii, p. 252.

Hipposideros fulvus, murinus, and atratus, Keluart, *Prod.* pp. 15, 16.

Hipposideros cineraceus, Blyth, *J. A. S. B.* xxii, p. 410.

Hipposideros cineraceus and murinus, Blyth, *Cat.* p. 27; Jerdon, *Mam.* p. 28.

Phyllorhina fulva, Dobson, *P. Z. S. B.* 1872, p. 155; *id. J. A. S. B.* xli, pt. 2, p. 220, xliii, pt. 2, p. 235; *id. P. Z. S.* 1873, p. 250; *Anderson, An. Zool. Res.* p. 98; *Scully, J. A. S. B.* lvi, pt. 2, p. 248.

Phyllorhina bicolor, Hutton, *P. Z. S.* 1872, p. 702; *Dobson, Mon. As. Chir.* p. 70; *id. Cat. Chir. B. M.* p. 148; *Anderson, Cat.* p. 117.

Hipposiderus bicolor, W. Blanford, *J. A. S. B.* lvii, pt. 2, p. 262.

Ears extending to the end of the muzzle when laid forward, broad, with very blunt rounded tips, outer margin straight, not concave below the tip. A low raised band of skin connects the base of the ears across the crown of the head; this band is hairy and requires to be looked for.

*Nose-leaf small, oblong; no secondary leaflets at the side of the horseshoe, which is of about the same width as the posterior leaf, or rather narrower; sella less broad transversely than the anterior leaf; posterior leaf rounded behind, the front surface concave, divided longitudinally into four cells. Frontal sac well developed in males, rudimentary in females.

Wing-membrane from the ankle or tarsus; interfemoral membrane projecting angularly slightly behind; tip of tail free.

Colour varying from golden chestnut to very dark reddish brown, almost black, above, paler, sometimes white, below. The fur is generally pure white, buffy white, or grey for three-quarters of its length, the tips reddish brown, or ashy brown, or blackish. Some specimens are brilliant golden or bright ferruginous. Dobson found that several golden-coloured specimens examined by himself were pregnant females, but males were subsequently obtained by Anderson in Burma exhibiting the same brilliant coloration, though both males and females were found in adjoining caves of the usual coloration, whitish fur with dark tips.

Dimensions. A male Burmese specimen measured:—head and body 1.75 inches, tail 1.15, ear from crown 0.75, forearm 1.55.

Distribution. The Oriental region and part of the Australian. Throughout India from Sind, the Punjab, and North-west Himalayas, below about 5000–6000 feet, to Cape Comorin; also in Ceylon, Assam, Burma, &c.

Varieties. Dobson recognizes four varieties, chiefly distinguished by the size of the ears. One of these, however, *H. amboinensis*, with the shortest ears of all, is altogether smaller in size, and must I think, from its distribution throughout the same area, be kept distinct. Of the other varieties, one, *H. aruensis*, is not Indian; whilst the typical *H. bicolor*, with ears as long as the head, has only been found within our area in the Nicobar Islands; *H. fulvus*, with ears longer than the head, being the common Indian and Burmese form.

Habits. Scarcely any information is available. This species lives during the day in caves, old tombs, and other buildings, like most members of the family. If Dobson's suggestion be correct, the golden colour observed in some members of this species is assumed during the breeding-season only, and, if so, it is a manifest corollary that the season must vary in different individuals. A similarly brilliant coloration is occasionally found in *H. speciosus* and some other species and in the smaller *Rhinolophi*. This was noticed as long ago as 1852 by Blyth.

167. *Hipposiderus amboinensis.* *The little leaf-nosed Bat.*

? *Rhinolophus subbadius*, *Hodgson, J. A. S. B.* xiii, p. 486, *nec Blyth*.

Phyllorhina amboinensis, *Peters, MB. Akad. Berl.* 1871, p. 323;

Dobson, Mon. As. Chir. p. 72; *id. Cat. Chir. B. M.* p. 150; *Scully,*

J. A. S. B. lvi, pt. 2, p. 249.

Phyllorhina micropus, *Hutton, P. Z. S.* 1872, p. 703.

Ears when laid forward not extending to the end of the muzzle. Size considerably smaller, and projecting extremity of tail longer. In other respects this species agrees with *H. bicolor*, to which it was united by Dobson.

Dimensions. Head and body 1·7 inches, tail 0·95, ear from crown 0·45, forearm 1·4.

Distribution. This bat has been found at Mussoorie and Katmandu in the Himalayas, and at Lingasugúr, N.N.W. of Bellary in the Deccan; also in Amboyna.

H. stoliczkanus (*Phyllorhina trifida*, *Peters*), a small species with the posterior nose-leaf very peculiarly formed, is found in Penang. Although the type of *P. trifida* was said to be from Burma (*P. Z. S.* 1871, p. 513), the form has not yet been obtained except at the original locality.

Genus **CÆLOPS**, Blyth (1848).

Nose-leaf well developed, consisting of three parts. Anterior leaf bifid, composed of two distinct lappets, one on each side, from

beneath each of which a supplementary lappet extends forward over the muzzle. Sella transverse, as in *Hipposiderus*. Posterior leaf semicircular, the rounded posterior margin bent forward so as partly to conceal the front surface, and bearing a small heart-shaped, flat projection in the middle. Index finger extending beyond the end of the first phalanx of the middle finger. No tail. Calcaneum short and weak; interfemoral membrane deeply emarginate.

Dentition: i. $\frac{2}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$, as in *Hipposiderus*. The upper incisor has a small additional cusp in front, and a large one behind, both some distance above the base. First upper premolar small, placed internally to the tooth-row. The teeth generally resemble those of *Hipposiderus*.

168. *Cœlops frithi*. *The tailless leaf-nosed Bat.*

Cœlops frithi, Blyth, *J. A. S. B.* xvii, p. 251 (1848); *id. Cat.* p. 27; *Jerdon, Man.* p. 29; *Dobson, J. A. S. B.* xli, pt. 2, p. 141; *id. Mon. As. Chir.* p. 74; *id. Cat. Chir. B. M.* p. 152; *id. Rep. Brit. Assoc.* 1880, p. 180; *Anderson, Cat.* p. 119.

Ears rounded, the whole surface hairy, both margins convex, and the outer margin very much so, so as to form a large antitragal lobe, which, however, is not separated by any notch from the rest of the ear-conch. The supplementary lappets of the anterior nose-leaf come forward beyond the end of the muzzle. There are two or three tubercles on the nose-leaf close to the nostrils, which are much sunken. Sella very broad from front to back and with a raised rib in the middle. The sides of the nose-leaf covered with long hairs, as is the face generally. Behind the posterior leaf is a circular pore with a pencil of long hairs from it.

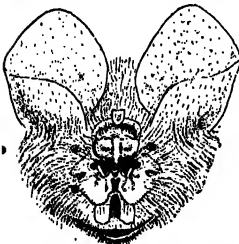


Fig. 88.—Head of *Cœlops frithi*. (Dobson, *Cat. Chir. B. M.*)

Metacarpal bone of thumb very long, phalanx short; the thumb included in the wing-membrane to the base of the claw.

Wings from the metatarsus. The posterior border of the interfemoral membrane angularly emarginate as far as a line between the knees.

Colour dusky, the fur tipped with dull ashy brown above, paler and somewhat albescent below, according to Blyth, but Dobson says shining brown above and below, the bases of the hairs much paler. There is probably some variation.

Dimensions. Head and body 1·7 inches, depth of interfemoral membrane in middle 0·3, ear from crown 0·45, forearm 1·6, thumb without claw 0·3 (of which the metacarpal is 0·25).

Distribution. This was originally described from a Sundarban specimen, but has recently been discovered at Darjiling by Col. Kinloch. It has also been found in Siam and Java.

Family NYCTERIDÆ.

A distinct nose-leaf around the nostrils, which are situated on the upper surface of the muzzle. Ears large, united at the base; tragus well developed. Middle finger with two phalanges, of which the first is extended in repose, in a line with the metacarpal bone; index finger with or without a phalanx besides the metacarpal; tibia long, fibula rudimentary or absent. Premaxillary bones cartilaginous or small; upper incisors small or absent; molars well developed.

The nasal appendages are much less complicated than in the *Rhinolophidæ*, but are well developed in the Indian forms belonging to the present family.

The *Nycteridæ* inhabit the Ethiopian, Oriental, and Australian regions. Two subfamilies, each containing a single genus, are recognized by Dobson, but only one of these occurs within Indian limits.

Genus **MEGADERMA**, Geoffr. (1810).

Muzzle long; nostrils in a depression near the extremity, surrounded by a naked expansion or nose-leaf, which extends to the end of the muzzle anteriorly and for some distance posteriorly between the eyes; the nostrils are covered and concealed by a second smaller flat leaf, resting upon the other; the lower lip, when viewed from above, is seen to project beyond the upper. Ears large, joined at the base; tragus long, bifid. No external tail. Wings ample; interfemoral membrane large, concave behind. Index finger with a single short bony phalanx besides the metacarpal bone; tibia very long; calcaneum distinct. A pair of pubic teat-like appendages as in the *Rhinolophidæ*.

Dentition: i. $\frac{0}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$, in both Indian species.

The upper canine has a pointed internal basal cusp, directed



Fig. 89.—Skull of *Megaderma lyra*. (Dobson, Mon. As. Chir.)

obliquely inwards, and resembling an incisor, also a large posterior cusp. The first upper premolar is exceedingly minute, and situated

quite inside the anterior lobe of the large second premolar; the last molar is scarcely half the size of either of the anterior molars. Lower incisors equal, tricuspid. The African forms want the first upper premolar entirely.

Species of *Megaderma* are found in Southern Asia, the Malay Archipelago, in Australia and in Africa. Two forms occur within Indian limits.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Posterior termination of nose-leaf truncated.... *M. lyra*, p. 293.
 B. Posterior termination of nose-leaf rounded.... *M. spasma*, p. 294.

169. *Megaderma lyra*. *The Indian Vampire Bat.*

Megaderma lyra, *Geoffr. Ann. Mus.* xv, p. 190 (1810); *Blyth, J. A. S. B.* xi, p. 255, xiii, p. 480, xx, p. 156; *id. Cat.* p. 22; *Kelaart, Prod.* p. 11; *Jerdon, Mam.* p. 22; *Dobson, P. A. S. B.* 1872, p. 203; *id. Mon. As. Chir.* p. 78; *id. Cat. Chir. B. M.* p. 156; *Anderson, Cat.* p. 120.

Vespertilio (*Megaderma*) *carnatica*, *Elliot, Mad. Jour. L. S.* x, p. 96.

Megaderma spectrum, *Wagner, Hügel's Kaschmir*, iv, p. 569, pl.; *Jerdon, Mam.* p. 22.

Megaderma schistacea, *Hodgson, J. A. S. B.* xvi, p. 889, pl. xxxix.

Ears very large, extending, when laid forward, considerably beyond the muzzle, their inner margins united for more than one third the length; their tips broadly rounded off, margins convex,



Fig. 90.—Head of *Megaderma lyra*. (Copied from Dobson, *Cat. Chir. B. M.*)

outer margins terminating halfway between the tragus and the angle of the mouth. Tragus very large, bifid, the posterior portion long and pointed, the anterior portion about half the length of the posterior, rounded on its anterior margin and above.

Nose-leaf rounded in front, not varying much in breadth, but with a notch on each side behind the nostrils, dividing it into an anterior and posterior portion, the latter much the longer, having

the sides slightly convex and the posterior termination cut off squarely. The additional leaf that covers the nostrils is rounded below and joined to a prominent rib that traverses the posterior leaf from end to end, a deep groove corresponding to it on the lower surface. Lower lip with a projecting triangular naked extremity, divided by a deep median groove.

Wing-membranes from the back of the foot, at the base of the two outer toes. Fur soft and moderately long.

Colour of fur dark ashy or slaty grey above, paler, sometimes whitish, below.

Dimensions. Head and body 3·4 inches, ear from crown 1·1 (from origin of outer margin 1·6), forearm 2·6.

Distribution. India generally from Kashmir to Cape Comorin, and Ceylon; occurring west as far as Karáchi, and east to Calcutta and Mymensingh. This species is also found in China (Amoy, see Swinhoe, *P. Z. S.* 1870, p. 616; and Swatow, whence there is a skin in the British Museum). Hitherto, however, this bat has not been recorded from Burma. Col. McMaster notices the destruction of two canaries by bats in Rangoon, and suggests this species as the depredator, which is not improbable.

Habits. During the day this bat hides in caves, old buildings, roofs of houses, &c. The food may consist partly of insects; but it is certain that *Megaderma lyra* feeds on smaller bats, for one was detected and observed in the act by Blyth, and it probably lives chiefly on small Vertebrata. Mr. Frith informed Blyth that at Mymensing the verandah of his house was a favourite resort of a number of these bats, and that every morning the floor was strewn with the hind quarters of frogs and the wings of large grasshoppers and crickets; on one occasion the remains of a small fish were observed, but frogs appeared to constitute the bats' chief diet, never toads; and of a quiet evening these animals could be heard crunching the heads and smaller bones of their victims.

In the case observed by Blyth of a *Megaderma* killing and eating a smaller bat (*Vesperugo abramus*), the former began by seizing its prey behind the ear and sucking the blood during flight. Dobson shows that the peculiar dentition and lips of *Megaderma* are evidence of its prey differing from that of other insectivorous bats.

Hodgson has observed that in this species males greatly exceed females in number. Anderson found the young adhering to the abdominal teats and moving about from them to the true or pectoral mammae. Hodgson found a single young in many pregnant females examined by him at the end of February.

170. *Megaderma spasma*. *The Malay Vampire Bat.*

Vespertilio spasma, *L. Syst. Nat.* i, p. 47 (1760).

Megaderma spasma, *Cantor, J. A. S. B.* xv, p. 179; *Blyth, J. A. S. B.* xxi, p. 346, xxiv, p. 711; *id. Cat.* p. 23; *Dobson, Mon. As. Chir.* p. 79; *id. Cat. Chir. B. M.* p. 167; *Anderson, Cat.* p. 121; *W. Blauf. J. A. S. B.* lvii, pt. 2, p. 264.

Megaderma horsfieldi, *Blyth, Cat.* p. 23.

Rather smaller than *M. lyra*, and nose-leaf shorter.

Ears rounded, extending beyond the muzzle when laid forward; inner margins united by less than a third of their length. Tragus bifid, the posterior limb pointed, more than double the length of the rounded anterior limb.

Nose-leaf rounded posteriorly, the lanceolate portion behind the lateral emarginations about equal in length to the anterior portion. The additional leaf above the nostrils heart-shaped and broad, projecting laterally beyond the edge of the principal leaf. A raised median rib to the posterior rib.

Wing-membrane from the metatarsus. Interfemoral membrane deeper than in *M. lyra*. In other characters the two species are similar.

Colour of fur dark ashy above, paler below.

Dimensions. Head and body 3·4 inches, ear from crown 1·2, from origin of outer margin 1·5, forearm 2·3.

Distribution. Tenasserim, Siam, Cochin China, and the Malay Peninsula and Archipelago; also Ceylon, and probably Travancore. A description by Mr. Bourdillon of a bat obtained by him at Mynall, Travancore, from a hollow tree in dense forest at 2700 feet elevation, appears to refer to this species, and this serves to confirm the statement by Blyth that he had examined specimens from Ceylon. There are specimens in the British Museum labelled from the island. They are rather small, forearm 2·1 to 2·2 inches.

Of the other genus belonging to the present family, *Nycteris*, having the nostrils at the anterior extremity of a long facial groove, and a long tail, one species, *N. javanica*, has been found in the Malay Peninsula and Java, the remaining species are all African.

Family VESPERTILIONIDÆ.

This is by far the largest family of bats and comprises most of the commoner forms found in India. The species are at once and readily distinguished from all other *Microchiroptera* (so far at least as the Indian and Palearctic forms are concerned) by the presence of a tragus, by the absence of all trace of nose-leaf, by the tail neither being produced to any great extent beyond the interfemoral membrane, nor exerted from its upper surface, and by the presence of two phalanges besides the metacarpal bone, making three joints altogether, in the middle finger, with the first phalanx in repose extended in a line with the metacarpal bone. The eyes are minute, and the inner margins of the ears arise from the sides of the head, not from the forehead. The tail is long.

The lower incisors are always six in number, the upper incisors

vary from 2 to 4, divided by a wide space in the middle, and placed in pairs or singly near the canine. The upper premolars vary from one to three in number on each side; when more than one occur, the anterior premolars are generally very small, and sometimes have a position inside the general line of the teeth, or tooth-row. The lower premolars are 2 or 3 on each side.

Members of this family are found throughout the tropical and temperate regions of the world, extending even to many oceanic islands.

Whilst the majority of the genera are well defined and easily recognized, the two great groups comprised in *Vesperugo* and *Vespertilio* contain several intermediate forms, so that although most of the species fall readily into two perfectly distinct genera, the actual line of distinction is artificial and depends on the presence or absence of an upper premolar*, which is, in some cases, not to be detected without the aid of a lens. The genera found in India may be thus distinguished:—

- | | |
|---|------------------|
| A. Crown of head but little raised above face-line; second or terminal phalanx of third or longest finger not more than double length of first phalanx. | |
| a. Ears distinctly united at base. | |
| a'. Ears enormous, outer margin of each terminating behind angle of mouth | PLECOTUS. |
| b'. Ears moderate, outer margin carried forward and terminating above mouth | SYNOTUS. |
| b. Ears not united at base. | |
| a'. Ears very large, about double length of head | OTONYCTERIS. |
| b'. Ears moderate, about same length as head or less. | |
| a''. Outer margin of ear-conch terminating about halfway between tragus and angle of mouth; 4 or 5 teeth behind canine on each side of upper jaw. | |
| a'''. Two pairs of upper incisors | VESPERUGO. |
| b'''. Only one pair of upper incisors; one on each side, close to canine | NYCTICEJUS. |
| b''. Outer margin of ear terminating nearer to tragus than to angle of mouth. | |
| a'''. Nostrils tubular, projecting; 5 teeth behind canine on each side of upper jaw | HARPYIOCEPHALUS. |
| b'''. Nostrils simple; 6 teeth in upper molar row. | |
| a. Nostrils crescentic | VESPERTILIO. |
| β. Nostrils rounded | CERIVOULA. |

* In specimens preserved in spirit the mouth can be opened widely and the teeth examined with a microscope if necessary. With bats, however, as with other small mammals, it is well to extract and clean one or two skulls of each species.

- B. Crown of head greatly raised above face-line; outer margin of ear terminating close to angle of mouth; second or terminal phalanx of third or longest finger more than treble the length of first phalanx **MINIOPTERUS.**

. Genus **PLECOTUS**, Geoffr. (1813).

Ears very large, the inner margins united, outer margin of each terminating just behind the angle of the mouth; tragus large, tapering. Nostrils elongate, narrow, crescentic, situated at the extremity of the muzzle, the upper surface of which is hairy, flat and depressed in the middle, but swollen at the sides, which bulge above the central depression, and sometimes cover it just behind the nostrils. Muzzle not grooved in front below the nostrils.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{4-1}$, pm. $\frac{2-2}{3-3}$, m. $\frac{3-3}{3-3}$. Upper incisors widely separated in the middle and directed obliquely inwards, the inner are bifid, the inner cusp of each considerably longer than the outer, and this again is larger and longer than the small simple unicuspidate outer incisor; canines without accessory cusps; first upper premolar small, but distinctly seen from the outside, second premolar large. Of the lower premolars the third is the largest and the second the smallest.

The only Palearctic species, which has an extensive range, is found in the Himalayas.

171. **Plecotus auritus.** *The long-eared Bat.*

Vespertilio auritus, L. *Syst. Nat.* i, p. 47 (1766).

Plecotus homochrous, Hodgson, *J. A. S. B.* xvi, p. 895.

Plecotus auritus, Blyth, *Cat.* p. 35; Jerdon, *Mam.* p. 47; Hutton, *P. Z. S.* 1872, p. 704; Dobson, *Mon. As. Chir.* p. 84; *id.* *Cat. Chir. B. M.* p. 178; Anderson, *Cat.* p. 123; Scully, *P. Z. S.* 1881, p. 199.

Ears enormous, not much shorter than the head and body together, ovate, the tips broadly rounded. Inner margins joined near the base, just above the junction a prominent rounded lobe projects from each.

Wings from the base of the toes; feet slender. Tail as long as the head and body; the tip exserted. Fur soft.

Colour brown, generally fawn-colour or light brown above, whitish below. The basal half or two-thirds of the fur, above and below, is nearly black. Some specimens are dark throughout, owing to the wearing away of the paler tips to the hairs; such a specimen is the type of Hodgson's *P. homochrous*.

Dimensions of a female from near Mussoorie: head and body 1·7 inches, tail 1·7, ear from crown 1·35, tragus (inner margin)

0·7, forearm 1·65 (Hutton's measurements of, I believe, this individual when fresh are larger; head and body $2\frac{1}{4}$, &c.).

Distribution. The Palearctic region, including the higher portions of the Himalayas from Gilgit (Scully) and Leh (Stoliczka) to Darjiling. The Himalayan variety has rather longer ears than the European, but the short thumb, observed by Dobson in Hodgson's type of *P. homochrous*, appears to be an individual peculiarity, as it does not exist in other Himalayan specimens.

Habits. The long-eared bat, according to Blasius, hides in hollow trees or old buildings (probably in caves also) during the day and comes out rather late in the evening. The flight is not rapid, but the twists and turns are quickly made. This species only flies in the summer months, hibernating in the winter. The ears are usually folded under the arms during sleep.

Genus **SYNOTUS**, Keys. & Blas. (1839).

Syn. Barbastellus, Gray, 1838 (*nec* 1831).

Ears of moderate size, the inner margins coming forward at the forehead rather in front of the eyes and united at the base; the outer margin of each ear carried forward below the eye and terminating between the eye and upper lip; thus the eye, which is minute, is within the external ear; tragus well developed, attenuate above.

Muzzle short, the upper surface naked and flat in the middle, the sides glandular and swollen so as to form a raised border, the nostrils at the end of the muzzle, a broad shallow groove from each across the upper lip.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Upper incisors oblique, outer pair small, inner pair large and bifid; upper canines with small anterior and posterior basal cusps. First upper premolar minute, in the inner angle between the closely approximate canine and second premolar. First lower premolar half the height and breadth of the second.

This genus comprises two known species, both Palearctic; one of them is found in the Himalayas.

172. *Synotus darjelingensis*. *The Eastern Barbastelle*.

Plecotus darjelingensis, Hodgson, Horsfield, *A. M. N. H.* (2) xvi, p. 103 (1855).

Barbastellus communis, Blyth, *J. A. S. B.* xxi, p. 360, xxiv, p. 363; *id. Cat.* p. 36; Jerdon, *Mam.* p. 48; Hutton, *P. Z. S.* 1872, p. 703; Dobson, *J. A. S. B.* xliii, pt. 2, p. 236, *nec* Gray.

Barbastellus dargelinensis, Dobson, *P. A. S. B.* 1875, p. 85.

Synotus darjelingensis, Dobson, *Mon. As. Chir.* p. 86; *id. Cat. Chir. B. M.* p. 177; Andersen, *Cat.* p. 123; Scully, *P. Z. S.* 1881, p. 199.

The ears are very broad and, when laid forward, extend beyond the nostrils, tips broadly rounded, inner margin convex, outer almost straight for nearly half its length, and without any projecting lobe, lower half also nearly straight. Tragus broad at the base, and becoming broader just above the commencement of the inner margin, but attenuate thence to the narrow but rounded tip.

Wings from the base of the toes. Calcaneum extending half-way from the foot to the end of the tail. Postcalcaneal lobe narrow. Tail as long as the head and body; tip projecting from interfemoral membrane, which extends triangularly far behind the feet. Fur soft and long.

Colour greyish black, the hairs with paler greyish tips, more conspicuous below than above.

Dimensions. Head and body 2 inches, tail 1.9, ear from crown 0.45, forearm 1.65.

Distribution. This form, which is distinguished from the European *Synotis barbastellus* by larger ears without any projecting lobe to the outer margin, appears to be common in the Himalayas at an elevation of 5000-8000 feet, and has been taken at Gilgit, Simla, Mussoorie, and Darjiling, in Upper Sikkim at Lachung, and also in the Khási hills south of Assam. The same bat was also procured by Stoliczka in Eastern Turkestan, and may very possibly replace *S. barbastellus* in Central and Eastern Asia.

Habits. According to Hutton the Eastern barbastelle makes its appearance rather late in the evening. It hibernates in winter. He remarks on the very narrow holes and crevices into which it squeezes itself. The European form is said to appear in the evening before *Plecotus auritus* and to fly higher and more rapidly*.

Genus OTONYCTERIS, Peters (1859).

Head very flat; nostrils crescentic, at the extremity of the muzzle. Ears large, separate†; tragus long.

Dentition: i. $\frac{1-1}{6-}$, c. $\frac{1-1}{1-1}$, pm. $\frac{1-1}{2-2}$, m. $\frac{3-3}{3-3}$. The upper incisors close to the canines and bifid, the outer cusps very small; single upper premolar large, close to the canine; lower incisors flattened laterally, the longer diameter of each transverse to the line of teeth; first lower premolar scarcely half the size of the second.

* An Australian bat, *Nyctophilus geoffroyi* (*N. timoriensis*, see Dobson, Cat. Ohir. B. M. p. 172), was by mistake included by Jerdon (Mam. Ind. p. 48) amongst Indian forms and stated to have been sent from Mussoorie by Hutton, who, however (P. Z. S. 1872, p. 704), denied all knowledge of the species. It is evident that the error, which has puzzled some writers on the Indian Mammalia, arose from a mistake in the printing of Blyth's Catalogue (see J. A. S. B. lvii, pt. 2, p. 264).

† According to Dobson, there is, hidden amongst the hairs of the forehead, a very low band that connects the ears, but practically they are separated.

Of this genus, which is evidently allied to *Plecotus*, only one species is known.

173. *Otonycteris hemprichi*. *Hemprich's long-eared Bat*.

Otonycteris hemprichii, *Peters, M.B. Akad. Berl.* 1859, p. 223;
Dobson, Cat. Chir. B. M. p. 182; *Scully, P. Z. S.* 1881, p. 109.

Ears large, very much longer than the head, oval, broadly rounded at the tips, inner margin convex, lower third especially so, but without any projection, outer margin nearly straight for the upper half, then convex, emarginate opposite the base of the tragus, terminating behind the angle of the mouth. Tragus long, attenuate, rounded at the end.

Wings from the base of the toes. Tail long, the point beyond the triangular extremity of the interfemoral membrane. No post-calcaneal lobe. Fur long, dense, and soft.

Colour above pale sepia-brown, all the basal portions of the hairs white, below white; membranes and ears pale brown.

Dimensions. Head and body 3 inches, tail 2·3, ear from crown 1·25, forearm 2·6.

Distribution. Two specimens have been obtained in Gilgit, one by Col. Biddulph, the other by Dr. Scully. The type was brought by Hemprich and Ehrenberg from N.E. Africa, and a specimen has recently been recorded from Algeria.

Genus **VESPERUGO**, Keys. & Blas. (1840).

Syn. *Noctulinia*, Gray (1842); *Scotophilus*, partim, Gray, nec Leach;
Myotis, partim, Blyth, nec Gray.

Ears separate, moderate or short, generally much shorter than the head, each outer margin terminating behind the angle of the

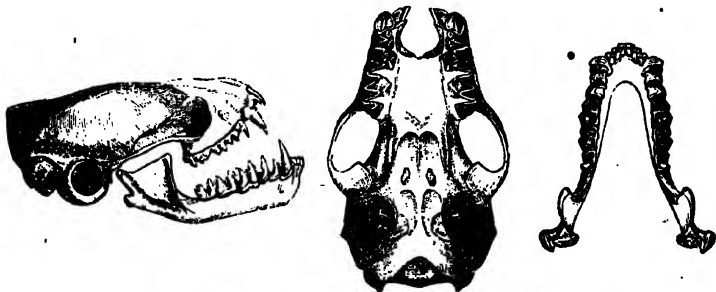


Fig. 91.—Skull of *Vesperugo noctula*, $\times 2$. (Blasius, Säugeth. Deutschlands.)

mouth and considerably in front of the base of the tragus; the terminal portion of the outer margin usually consists of a

rounded lobe or antitragus, the inner margin is turned inwards near the base and generally forms a rounded edge termed the basal lobe. Tragus generally short and obtuse, the outer margin more or less convex, the inner straight or concave.

Muzzle, in most species short and obtuse*, with prominent glandular swellings at the side between the eyes and nostrils, increasing the width of the face; the sides of the head as far back as the ears, and extending upwards to above the eyes, together with the terminal portion of the muzzle above from a little in front of the eyes, are very thinly covered with hair. Tail shorter than the head and body together; there is a small membranous expansion (the postcalcarial lobe), varying much in form and development, behind the calcaneum, and the interfemoral membrane always ends posteriorly in a salient angle. Wings (except in *V. noctula*, *V. leisleri*, and two Malayan species) from the base of the toes.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$ or $\frac{1-1}{2-2}$, m. $\frac{3-3}{3-3}$. The upper incisors in pairs inclined inwards and separated by a wide interval in the middle, outer incisor of each pair close to the inner and parallel to it; the inner generally the larger of the two and often bifid, the outer sometimes very small (see fig. 92, p. 306). First upper premolar minute or wanting, often, when present, difficult to detect. First lower premolar in the tooth-row, not crushed in between the adjoining teeth; its summit directed slightly outwards.

This genus of bats, which comprises more species than any other, and contains the commonest and most widely spread forms, is found in all extensive land areas, except those of the polar regions, but is particularly well represented in the temperate and sub-tropical portions of the Eastern hemisphere. All the species have a rapid flight with very sudden twists and turns, and many are amongst the first bats to appear in the evening and the earliest to leave their winter-quarters in the spring. In the majority of the species, according to Blasius, unlike other bats, the females produce two young at a time; but Dobson found one to be the rule in the numerous specimens that he examined.

On account of the number of species included, attempts have been made to divide the genus, but the subgenera, with the exception of *Hesperoptenus*, are ill defined and more or less artificial. This is especially the case with the two largest subgenera, *Vesperus* and *Vesperugo*. The small first upper premolar, wanting in the first but present in the latter, is sometimes to be distinguished from outside between the canine and the second premolar, but often it can only be detected by the use of a good lens when the mouth is widely opened.

* *V. annectens* differs in this and several other characters.

Synopsis of Indian, Ceylonese, and Burmese Species of Vesperugo.

- A. Incisors $\frac{2-2}{6}$; outer upper incisors in a line with inner or anterior to them; premolars $\frac{1-1}{2-2}$ (four teeth behind canine in the upper jaw); wings from base of toes Subgenus *VESPERUS*.
- a. No thickened base to ear, nor swollen pads to feet.
- a'. Forearm 2 inches or more long *V. serotinus*, p. 303.
Forearm less than 2 inches.
- a''. No postcalcanal lobe; forearm 1.45. *V. nasutus*, p. 304.
- b''. Postcalcanal lobe present.
- a. Ears much shorter than head.
- a'. Tragus broadest below middle of inner margin; forearm 1.5 *V. borealis*, p. 305.
- β' . Tragus broadest above middle of inner margin; forearm 1.6 *V. discolor*, p. 305.
- β . Ears nearly as long as head; forearm 1.7 *V. atratus*, p. 306.
- b. Base of ear thickened; forearm 1.6 *V. pachyotis*, p. 307.
- c. Soles of feet and base of thumbs with broad fleshy pads; forearm 1.1 *V. pachypus*, p. 307.
- B. Incisors $\frac{2-2}{6}$, outer upper incisors in same line as inner, or anterior to them; premolars $\frac{2-2}{2-2}$ (five teeth in upper jaw behind canine), first upper premolar minute Subgenus *VESPERUGO*.
- a. Wings from ankles.
- a'. Forearm 2 inches or more *V. noctula*, p. 308.
- b'. Forearm about 1.65 *V. leislerei*, p. 309.
- b. Wings from base of toes.
- a'. Tragus rounded above.
- a''. Tragus broadest about middle of inner margin.
- a. Fur above black.
- a'. Outer upper incisors but little shorter than inner; a postcalcanal lobe; forearm 1.55 *V. mordax*, p. 310.
- β' . Outer upper incisors very short; no postcalcanal lobe; forearm 1.5 *V. circumdatus*, p. 312.
- β . Fur above brown.
- a'. Outer upper incisors acutely pointed; forearm 1.55 *V. affinis*, p. 311.
- β' . Outer upper incisors hollowed to receive lower canines; forearm 1.65 *V. ceylonicus*, p. 312.
- b''. Tragus broadest slightly above base of inner margin.
- a. Outer upper incisors more than half length of inner.
- a'. Outer margin of ear below tip straight; forearm 1.3 *V. abramus*, p. 313.
- β' . Outer margin of ear below tip concave; forearm 1.25 *V. pipistrellus*, p. 314.

- β . Outer upper incisors less than half length of inner; interfemoral membrane white-edged; forearm 1.4. *V. kuhli*, p. 315.
- b*. Tragus pointed above; face hairy; forearm 1.8. *V. annectens*, p. 316.
- C. Incisors $\frac{2-2}{6}$, outer upper incisors very small, behind inner incisors; pm. $\frac{1-1}{2-2}$; wings from base of toes. Subgenus *HESPEROPTENUS*.
- a*. Forearm 2.1 inches. *V. tickelli*, p. 317.
- b*. Forearm 1.1. *V. blanfordi*, p. 317.

174. *Vesperugo serotinus*. *The Serotine*.

- Vespertilio serotinus*, *Schreb. Säugeth. i*, p. 167, pl. 53 (1775).
- Scotophilus serotinus*, *Blyth, J. A. S. B. xxi*, p. 360; *id. Cat.* p. 32; *Jerdon, Mam.* p. 34.
- Scotophilus pachyomus*, *Tomes, P. Z. S.* 1857, p. 50; *Jerdon, Mam.* p. 34.
- Vesperugo andersoni*, *Dobson, P. A. S. B.* 1871, p. 211; *id. Mon. As. Chir.* p. 110; *id. Cat. Chir. B. M.* p. 125; *id. Rep. Brit. Assoc.* 1880, p. 184; *Anderson, An. Zool. Res.* p. 101, pl. iv, figs. 2-6; *id. Cat.* p. 124.
- Vesperugo serotinus*, *Dobson, Mon. As. Chir.* p. 108; *id. Cat. Chir. B. M.* p. 191; *id. Second Yarkand Miss., Mam.* p. 12; *Anderson, Cat.* p. 124.

Ears of moderate size, the broadly rounded tips, when laid forward along the face, are rather nearer to the nostril than to the eye; inner margin slightly convex, basal lobe rounded, outer margin straight or very slightly concave for its upper half, then convex, slightly emarginate opposite the base of the tragus and ending in a convex lobe behind the angle of the mouth. Tragus broadest just above the base of the inner margin, thence diminishing slowly in breadth to the tip, which is rounded, inner margin straight or slightly concave, outer convex with a small projecting rounded lobe at the base.

Head flat. Muzzle flat and thick, the sides swollen and glandular; face almost naked in front, but the upper lip fringed with hair. Thumb with a callosity at the base. Wings from the metatarsus close to the base of the toes. Postcaneal lobe very narrow. Last two caudal vertebrae free.

Upper inner incisors long, strong, bifid at their extremities, when not worn down; outer incisors very short, scarcely one third the length of the inner pair, and lying against their outer and anterior sides. Lower incisors trifid, crowded. First lower pre-molar half the breadth and half the height of the second.

V. andersoni, with smaller and narrower ears, a rather smaller foot, only the last caudal vertebra free, and some other slight differences, was ultimately classed by its describer as a variety of the *Serotine*.

Colour. Above dark smoky brown as a rule, below yellowish brown to yellowish white. Specimens from dry desert countries are pale buff-brown above, paler beneath.

Dimensions of a male from Kashmir. Head and body 2·85 inches, tail 2, ear from crown 0·5, forearm 2·1.

Distribution. Palearctic and Nearctic regions, with parts of the Neotropical and Oriental. This bat seems to be common in Kashmir, and was found in Assam by Col. Godwin-Austen. Blyth, too, identified it amongst the bats obtained near Mussoorie by Hutton. The variety *V. andersoni* was obtained in Yunnan.

Habits. The name of this bat indicates one of its characteristic traits, that of appearing late in the evening. It likewise does not come out of its winter sleep until the spring is well advanced. According to Blasius it does not fly about on cold, wet, and windy nights, but it is to be seen, in Europe, on warm summer evenings about woods and gardens. It is frequently found in hollow trees in the day, and remains as a rule solitary or in small numbers even in winter. Its flight is rather slow and the action of its wings fluttering; its turns are less actively made than those of its allies of the genus *Vesperugo* generally. As a rule it has only one young at a time.

175. *Vesperugo nasutus*. *The Sind Bat*.

Vesperugo nasutus, Dobson, *J. A. S. B.* xlvii, pt. 2, p. 311 (1877);
id. *Cat. Chir. B. M.* p. 200; *Anderson, Cat.* p. 125.

Ears shorter than the head, triangular, the tips rounded; inner margin of each commencing above the eye, not forming a distinct rounded lobe at the base, but straight almost from the base to the tip of the ear, outer margin also straight. Tragus broadest below the middle of the inner margin, the outer margin convex with an ill-defined lobe near the base, inner margin slightly concave, tip subacutely pointed.

Head flat, muzzle conical, the extremity projecting considerably beyond the lower lip in front, nostrils opening sublaterally. No postcalcaral lobe. Only the tip of the tail is free. Fur short, the face nearly naked in front of the eyes.

Upper inner incisors moderately long and unicuspidate, outer pair very short; lower incisors trifid, crowded, longest across the direction of the jaws. First lower premolar not half as long as the second.

Colour above pale yellowish brown; beneath pale buff, almost white; membranes light brown, traversed by numerous white reticulations.

Dimensions. Head and body 1·8 inches, tail 1·7, ear (from base of outer margin) 0·6, forearm 1·45.

Distribution. The only specimen known was obtained by myself in Upper Sind. I believe that the type of the present species was procured a little east of Rohri. The locality originally assigned, Shikárpur, was that of some other specimens in the same collection.

The above description is taken from that by Dobson.

176. *Vesperugo borealis*. *The Northern Bat.*

Vespertilio borealis, Nilsson, *Illum. Fig. Scand. Fauna*, häft. 19, pl. 30 (1838).

Vesperugo nilssoni, Keys. & Blas Wiegmann, *Arch.* 1839, p. 315.

Vesperugo borealis, Dobson, *Mon. As. Chir.* p. 105; *id. Cat. Chir. B. M.* p. 203; Scully, *P. Z. S.* 1881, p. 200.

Ears nearly triangular, tips broadly rounded, outer margin straight almost to the base, where it turns forwards and after a distinct emargination terminates in a short but prominent lobe, just behind the angle of the mouth. Inner margin straight above, ending below in a rounded basal lobe. Outer margin of tragus very convex with a projecting lobe at the base, inner margin straight below and slightly concave above, tip rounded, greatest breadth below the middle of the inner margin.

Muzzle flat and of moderate breadth. Postcalcaral lobe distinct, but narrow; the two last caudal vertebrae free.

The inner upper incisor bifid, outer incisor as long as the outer and shorter cusp of the inner incisor, and equal to the latter in cross section at the base; lower incisors trifid, placed at right angles to the jaw, and overlapping each other, those next the canines rounded above and higher than the rest.

Colour of fur very dark brown, above with yellowish-brown tips, below with ashy.

Dimensions. Head and body 2 inches, tail 1·7, ear from crown 0·4, forearm 1·5.

Distribution. Throughout the northern Palearctic region, as far north as the Arctic Circle. This species has been obtained in Eastern Turkestan and China. The only specimen hitherto recorded within Indian limits was taken by Dr. Scully in Gilgit.

Habits. According to Blasius this species, which flies well and quickly, migrates north in summer, being only found in Northern Russia about August, and is, of all European bats, the least sensitive to cold and bad weather. According to the same authority, the female usually produces two young at a time.

177. *Vesperugo discolor*. *The particoloured Bat.*

Vespertilio discolor, Natterer, Kuhl, *Deutsche Flederm.* p. 43 (1817); *id. Wetterau Gesell. N. Annal.* i, p. 187 (1819).

Vesperugo discolor, Dobson, *Mon. As. Chir.* p. 106; *id. Cat. Chir. B. M.* p. 204; Anderson, *Cat.* p. 125; Scully, *P. Z. S.* 1881, p. 190.

Ears oval, tips broadly rounded; outer margin straight for the upper third, folded back on itself about the middle, emarginate opposite the base of the tragus, and terminating in a long, but not prominent lobe behind and a little above the angle of the mouth, a tubercle between the termination and the angle; inner margin very slightly convex above, more so below, and with a prominent rounded basal lobe. Outer margin of tragus with a small projecting basal lobe, above very convex, tip rounded, inner

margin straight, broadest portion of tragus just above the middle of the inner margin.

Muzzle broad, flat above, end of the nose and upper lip projecting slightly beyond the lower; postcalcaral lobe narrow. Last caudal vertebra and part of penultimate free.

Inner upper incisor long, bifid; the outer incisor is shorter than the outer and shorter cusp of the inner incisor. First lower premolar about half the height of the second.

Colour of the fur above dark brown with pale yellowish-brown tips, below dark brown with ashy or whitish tips longer than those on the back, the dark basal part of the hairs producing a somewhat mottled appearance on the dorsal surface.

Dimensions. Head and body 2 inches, tail 1.65, ear from crown 0.4, forearm 1.6.

Distribution. The Palearctic region throughout the temperate zone, keeping much to hills and mountains. Within Indian limits this species has been recorded only at Gilgit, where a few were found in summer at from 10,000 to 11,000 feet above the sea by Dr. Scully.

Habits. Very similar to those of the nearly allied *V. borealis*. The flight is rather stronger, but the animal is more sensitive to cold, and its range does not extend nearly so far to the north. The female is said by Blasius always to produce two young at a time.

178. *Vesperugo atratus*. *The sombre Bat*.

Nycticejus atratus, Blyth, *Cat.* p. 31 (no description); Jerdon, *Mam.* p. 38 (1867).

Vesperus atratus, Dobson, *P. A. S. B.* 1871, p. 212.

Vesperugo atratus, Dobson, *Mon. As. Chir.* p. 107; *id.* *Cat. Chir. B.* M. p. 206; Anderson, *Cat.* p. 125.

Ears oval, tips rounded, but appearing pointed when viewed from the side, owing to the conch being longitudinally folded, like in *Cerivoula*; inner margin convex, outer slightly hollowed beneath the tip, with an angular emargination opposite the base of the tragus, and terminating in a rounded lobe, the summit of which is marked by a small triangular notch. Tragus with a small rounded lobe at the outer side of its base, expanded above, convex externally and above, inner margin slightly concave. Wings from the base of the toes; last rudimentary caudal vertebra free. Fur long and dense.



Fig. 92.—Incisors and canines of *V. atratus*. (Dobson, *Mon. As. Chir.*)

Inner upper incisors very long and slightly bifid at the extremity; outer incisors minute, scarcely raised above the level of the gum and close to the base of the inner incisors.

Colour black throughout.

Dimensions. Head and body 1.9 inches, tail 1.8, ear (from base of outer margin) 0.6, forearm 1.7.

Distribution. Only recorded hitherto from Darjiling. The description is taken from Dobson's.

179. *Vesperugo pachyotis*. *The thick-eared Bat.*

Vesperugo pachyotis, Dobson, *P. A. S. B.* 1871, p. 211; *id. Mon. As. Chir.* p. 104; *id. Cat. Chir. B. M.* p. 206; *Anderson, Cat.* p. 126.

"Ears triangular above, with rounded tips; outer side straight without emargination; lower portion of the ear (from below the level of the tip of the tragus to the termination of the outer margin near the angle of the mouth) very thick and fleshy; tragus short, expanded above and curved inwards.

"Head flat, muzzle very broad and short, glandular prominences much developed; immediately behind them a furrow extends from the anterior corner of one eye to that of the other, beyond which the fur of the head does not pass." "Wing-membrane from the base of the toes. Teeth very small; inner incisors bifid at their extremities, much larger and longer than the outer."

Colour above dark brown throughout, below a lighter shade of brown.

Dimensions. Head and body 2·2 inches, tail 1·6, ear (from base of outer margin) 0·55, forearm 1·6.

Distribution. Only found hitherto in the Khási hills, south of Assam. The types, a male and female, in the Indian Museum, Calcutta, are the only specimens hitherto recorded.

The above description is copied from Dobson, who remarks that the species, which may be recognized by the peculiar thickness of the lower half of the ear-conch, is rather related in the form of the ears and muzzle to *V. noctula* and its allies, but that the first minute upper premolar, characteristic of those forms, is wanting.

180. *Vesperugo pachypus*. *The club-footed Bat.*

Vespertilio pachypus, Temminck, *Mon. Mamm.* ii, p. 217, pl. 54, figs. 4-6 (1835-41).

Scotophilus fulvidus, Blyth, *J. A. S. B.* xxviii, p. 203 (1859); *id. Cat.* p. 33.

Vesperus pachypus, Dobson, *P. A. S. B.* 1871, p. 212.

Tylonycteris pachypus, Peters, *MB. Akad. Berl.* 1872, p. 704; *Blyth, Mam. Birds Burma*, p. 23.

Vesperugo pachypus, Dobson, *Mon. As. Chir.* p. 115; *id. Cat. Chir. B. M.* p. 208; *Anderson, Cat.* p. 126; *Thomas, P. Z. S.* 1880, p. 59.

Ears short, scarcely extending to halfway between the eye and nostril when laid forward, oval, with broadly rounded tips; outer margin slightly convex, with a shallow but distinct emargination below the base of the tragus, and terminating in a convex lobe behind the angle of the mouth; inner margin straight in the middle, convex above, and with a well rounded basal lobe. Tragus short, widest opposite the base of the inner margin, which is nearly straight, tip rounded, outer margin convex and having a small lobe at the base.

Crown of head very flat, muzzle broad, nostrils directed somewhat

downwards. The under surface of the base of the thumbs and the soles of the feet expanded into fleshy pads. In some specimens the thumb-pad extends almost to the base of the claw. On the foot the pad forms an almost circular disk, the round margin projecting a little beneath the toes, which are short. Wings rather short; calcaneum short and feeble; postcalcaneal lobe rudimentary. Only the extreme tip of the tail projects from the interfemoral membrane.

Upper incisors all small, the inner bicuspid, the outer anteriorly placed and shorter than the smaller outer cusp of the inner; lower incisors not crowded.

Colour of fur moderately deep rich brown, with a rufous tinge above, paler below; dorsal hair a little paler towards the base.

Dimensions. A female from Darjiling measures:—head and body 1·5 inches, tail 1·05, ear from crown 0·25, forearm 1·05. Dobson gives rather larger measurements:—head and body 1·75, tail 1·3, forearm 1·1.

Distribution. Eastern Himalayas (Darjiling), Manipur, Tenasserim, Mergui Archipelago, Andaman Islands, and probably the Burmese and Malay countries generally, extending to Java, Sumatra, and the Philippine Islands.

The fleshy foot- and thumb-pads are supposed by Dobson to be adapted for adhering to the under surface of large leaves and fruits.

181. *Vesperugo noctula*. *The noctule Bat.*

Vespertilio noctula, Schreb. *Säugeth.* i, p. 166, pl. 52 (1775).

Vesperugo labiata, Hodgson, *J. A. S. B.* iv, p. 700 (1835).

Noctulinia noctula, Blyth, *J. A. S. B.* xiv, p. 340; *id.* *Cat.* p. 30;

Jerdon, *Mam.* p. 36.

Vesperugo noctula, Dobson, *Mon. As. Chir.* p. 88; *id.* *Cat. Chir. B. M.* p. 212; *Anderson*, *Cat.* p. 126; *Scully*, *J. A. S. B.* lvi, pt. 2, p. 250.



Fig. 93.—Head of *Vesperugo noctula*. (Blasius, *Säugeth. Deutschlands.*)

Ears thick, broadly rounded above, nearly as broad as long, extending very little beyond the eye when laid forward; outer margin convex and reflected backward, slightly notched below the base of the tragus, forming a thickened convex lobe in front of the notch and terminating behind the angle of the mouth; inner margin nearly straight above, convex below; basal lobe moderately

rounded. Tragus short, expanded above, curved inwards, broadest near the top, which is round; outer margin very convex, with a small pointed projection at the base; inner margin concave.

Head broad and flat, the glandular swellings at the sides of the muzzle very pronounced; nostrils projecting and directed outwards and downwards, space between them concave. Thumb short, with a small callosity at the base. Feet thick, toes short. Wing-membranes from the ankle. Postcalcaneal lobe well developed, rounded. Only the tip of the tail is free.

Inner upper incisor bicuspid in the young only, the small outer cusp disappearing in adults; outer incisor much shorter than the inner, but much broader in transverse section at the base, and having the crown hollowed out to receive the summit of the lower canine. Lower incisors with their broad crowns parallel, oblique to the jaw and overlapping each other. The first upper premolar very small, in the internal angle between the canine and the second premolar, which meet externally.

Colour of fur light yellowish brown, very little paler below, and the hairs on the upper surface paler towards the base. A specimen said to be from Ceylon is rather darker brown. Some European examples are said to be reddish brown.

Dimensions. Head and body 3 inches, tail 2, ear from crown 0.38, forearm 2.1.

Distribution. Found almost throughout the temperate Palearctic region and widely spread in the Ethiopian. This bat has been found in Nepal and Sikhim, and perhaps in Kaudahar; there are specimens in the British Museum labelled Ceylon and Singapore, and the species has been recorded from Sumatra and Java.

Habits. The noctule bat generally rests in trees during the day, though it is sometimes found in considerable numbers in buildings. It appears early in the evening, and has an especially strong and powerful flight, rising high in the air. It haunts wooded country, and lives largely on cockchafers and similar beetles. It hibernates thoroughly, never appearing till late in the spring, and it disappears soon in the autumn. Large numbers are found hibernating together. This species has a strong unpleasant odour. A good account of some of its habits, and especially of the birth of the young, by Mr. G. Daniell, will be found in the Proc. Zool. Soc. for 1834, p. 130. He found only a single young in several females; but Blasius states that two are generally produced. The young are born blind and naked.

182. *Vesperugo leisleri*. *The hairy-armed Bat.*

Vespertilio leisleri, Kuhl, *Deutsch. Fledern*, p. 38 (1817).

Scotophilus leisleri, Blyth, *J. A. S. B.* xxiv, p. 363; *id.* *Cat.* p. 33; Jerdon, *Mam.* p. 34.

Vesperugo leisleri, Hutton, *P. Z. S.* 1872, p. 707; Dobson, *Mon. As. Chir.* p. 91; *id.* *Cat. Chir. B. M.* p. 215.

Ears and tragus similar to those of *V. noctula*, as are all details of

structure except the dentition. The outer incisors equal to the inner in cross section at the base, but much shorter. Lower incisors in a semicircle scarcely overlapping each other. In this bat, as in the noctule, a band of fine short hair passes on the underside behind the forearm to the carpus, hence the English name.

Colour of fur bright yellowish brown above, light brown below, the basal three fourths of the hairs on both surfaces dark brown.

Dimensions. Head and body 2·4 inches, tail 1·6, ear from crown 0·25, forearm 1·65.

Distribution. Europe and the temperate regions of Asia. There are in the British Museum specimens collected by Hutton at Mussoorie, whence also the species was recorded by Blyth. It does not appear to have been observed elsewhere in the Himalayas.

Habits imperfectly known, Blasius saying that this species is a high-flyer and tree-haunter like *V. noctula*; whilst Bell in his 'British Quadrupeds' doubts its dwelling in trees, and states that its flight is much less steady and powerful than that of the noctule. It appears early in the evening.

There is in the British Museum a skin of *V. imbricatus*, marked Calcutta, and sent by Blyth to the East India Company's Museum. As the species is not mentioned by Blyth, and no specimens collected by him are in the collection at Calcutta, it is doubtful if the specimen above noticed is Indian. The species, which is found in the Malay Peninsula and Java, may be recognized by its comparatively large well-rounded ears, and its crescentic pointed tragus. The forearm measures 1·4.

183. *Vesperugo mordax.* *The grizzled Bat.*

? *Scotophilus maderaspatanus*, Gray, *List Mam. B. M.* p. 29 (1843), no description.

Vesperugo mordax, Peters, *MB. Akad. Berlin*, 1866, p. 402; Dobson, *Rep. Brit. Assoc.* 1880, p. 184; *W. Blanford. J. A. S. B.* lvii, pt. 2, p. 265.

Pipistrellus alustenianus, Dobson, *P. A. S. B.* 1871, p. 213.

Vesperugo maurus, Dobson, *Mon. As. Chir.* p. 99; *id. Cat. Chir. B. M.* p. 218, partim, nec Blasius; Anderson, *Cat.* p. 127.



Fig. 94.—Head of *Vesperugo mordax*. (Dobson, *Mon. As. Chir.*)

Ears thick, broad, triangular, rounded off above, extending when laid forward nearly halfway between the eye and the nostril; outer margin straight or concave above, convex and folded back below, distinctly notched below the base of the tragus, and terminating in a small lobe behind the angle of the mouth; inner margin straight above, convex below, with a rounded basal lobe. Tragus broadest

above the middle of the inner margin, which is straight; outer margin very convex above, tip rounded; at the base of the outer margin a pointed lobe, and above it a second very small projection, indistinct in some specimens.

Muzzle broad and flat, nostrils opening on a level with the muzzle. Wings from the base of toes. Postcalcaral lobe well developed, rounded. Last caudal vertebra free.

Upper incisors nearly equal in length, inner bifid; the outer cusp smaller, directed inwards, and disappearing with age. Lower incisors overlapping each other. First upper premolar small, quite internal to the tooth-row, but visible from without.

Colour of fur black or dark sooty brown, the hairs on the back behind the shoulders and on the lower parts with light grey tips. Membranes black; ears, nose, and skin of face the same.

Dimensions. Head and body 1.9 inches, tail 1.6, ear from crown 0.35, forearm 1.55.

Distribution. India (Kumaun, Sind, Allahabad, Deccan, Khási hills, Assam) and Java. Probably throughout the Oriental region, replacing the Palearctic *V. maurus* (or *V. savii*), which is a smaller species, widely distributed from the Canary Isles to China.

184. *Vesperugo affinis*. *The chocolate Bat*.

Pipistrellus affinis, Dobson, *P. A. S. B.* 1871, p. 213.

Vesperugo affinis, Dobson, *Mon. As. Chir.* p. 102; *id. Cat. Chir. B.*

M. p. 220; Anderson, *An. Zool. Res.* p. 100, pl. iv, figs. 7, 8; *id. Cat.* p. 128.

Ears broad, rounded, outer margins without emargination* or lobe, inner margins convex; a small tubercle with long hairs between the end of the outer margin and the angle of the mouth. Tragus with the inner margin straight; outer margin convex above, and having a small pointed lobe at the base, tip rounded.

Head flat; glands at the side of the muzzle much developed so as to produce a depression in the middle of the face behind the nostrils; anterior portion of face almost naked. The nostrils open sublaterally. Wing-membrane from the base of the outer toe, which is shorter than the others. Feet small. Tail long, of nine vertebrae, the last free. Upper incisors nearly equal in length; first upper premolar minute, internal.

Colour of fur chocolate-brown above, lighter on the head and neck; below dark brown, with light brown or ashy tips; on the pubes and along the thighs white or very pale buff.

Dimensions. Head and body 1.9 inches, tail 1.65, ear from base of outer margin 0.6, forearm 1.55.

Distribution. Bhámo, Upper Burma. A single specimen, now in the Indian Museum, Calcutta, was obtained by Dr. Anderson.

The above description is that of Dobson, slightly condensed. This bat is distinguished from *V. mordax* by colour, by the want of a notch in the outer ear-margin, and by the number of caudal vertebrae.

185. *Vesperugo circumdatus*. *The black Bat.*

Vespertilio circumdatus, *Temminck, Mon. Mam.* ii, p. 214, pl. 53, figs. 3, 4 (1835-41).

Vesperugo circumdatus, *Dobson, Cat. Chir. B. M.* p. 221.

Ears with rounded tips, outer margin concave below the rounded tip, then convex, notched opposite the base of the tragus, terminating in a convex lobe; inner margin straight above, convex below. Tragus broadest about the middle of its inner margin, terminating above in an acute angle, inner margin slightly concave, outer with a lobule at the base.

Nostrils scarcely projecting, opening sublaterally, the space between them concave. Terminal third of the muzzle half naked. Wings from the base of the toes; no postcalcaral lobe; half the last caudal vertebra free. Inner upper incisors long and strong, faintly bifid, outer very small; first upper premolar minute, in the inner angle between the closely approximated canine and second premolar. Lower incisors transversely placed at right angles to the jaws.

Colour of fur above intensely black, the extreme tips of some of the hairs bright ferruginous; beneath dull black, the tips of the hairs greyish. Membranes black. According to Temminck the black ears are margined by white, but this is not seen in dried specimens.

Dimensions of type from Java. Head and body about 2·4 inches, tail 1·3, ear from base of outer margin 0·5, forearm 1·5. In the only Indian specimen known the forearm measures 1·65.

Distribution. India and Java. The only specimen known from India is one presented by Jerdon to the British Museum, and this has no locality attached, but in all probability it was collected in Southern India.

186. *Vesperugo ceylonicus*. *Kelaart's Bat.*

Scotophilus ceylonicus, *Kelaart, Prod.* p. 22 (1852).

Vesperugo indicus, *Dobson, Cat. Chir. B. M.* p. 222 (1878).

Vesperugo ceylonicus, *W. Blanf. J. A. S. B.* lvii, pt. 2, p. 265.

Ears subtriangular, extending when laid forward two thirds the distance from the eye to the nostril; tips rounded, both margins nearly straight below the rounded tip; the basal lobe scarcely convex, outer margin concave, not notched, opposite the base of the tragus. Tragus varying but little in breadth for some distance above the base of the inner margin, which is straight; outer margin convex above, meeting the inner in an obtuse point, and bearing a distinct triangular lobe at the base.

Muzzle broad, sides swollen, middle of upper surface depressed. Wings from the metatarsus. Postcalcaral lobe well developed. Extreme tip of tail free.

Inner upper incisors bifid, the outer pair but little shorter than the outer and small cusps of the inner, and exceeding the inner in cross section at the base. The crown of the outer incisors is

hollowed out, as in *V. noctula*, to receive the point of the lower canine, and thus may appear bifid or trifid.

Colour of fur reddish brown above, hairs of the same tint from base to tip, pale brown below; the tips rather paler than the basal portion of the hairs.

Dimensions of a male from the Wyuaad. Head and body 2 inches, tail 1·8, ear from crown 0·45, forearm 1·65, tibia 0·58.

Distribution. Ceylon and the Malabar coast of India. A specimen presented by Sir W. Elliot to the British Museum and labelled Madras is probably from the Western Ghâts.

187. *Vesperugo abramus*. *The Indian Pipistrelle*.

♀ *Vespertilio* de Coromandel, *F. Cuv. Nouv. Ann. Mus. Hist. Nat.* i; p. 21 (1832).

Vespertilio imbricatus, *Temminck, Mon. Mam.* ii, p. 216, nec *Horsfield*.

Vespertilio abramus, *Temminck, ib.* p. 232 (1835-41).

Vespertilio coromandelicus, *Blyth, J. A. S. B.* xx, p. 159 (1851).

♀ *Myotis parvipes*, *Blyth, J. A. S. B.* xxii, p. 581; *Jerdon, Mam.* p. 46.

Scotophilus coromandelianus, *Blyth, Cat.* p. 33; *Jerdon, Mam.* p. 35.

Vesperugo imbricatus and *V. micropus*, *Hutton, P. Z. S.* 1872, pp. 707, 708.

Vesperugo abramus, *Dobson, Mon. As. Chir.* p. 97; *Cat. Chir. B. M.* p. 226; *Anderson, Cat.* p. 129; *Scully, J. A. S. B.* lvi, pt. 2, p. 250; *W. Blanford, J. A. S. B.* lvii, pt. 2, p. 266.

Ears subtriangular, rounded at the tips, when laid forward extending to about halfway between the eye and the nostrils, outer margin nearly straight or slightly concave; the concavity opposite the base of the tragus is slight; in front of this is a prominent lobe, terminating behind the angle of the mouth. Tragus a little curved forward, tip rounded, inner margin slightly concave, outer convex, with the usual small lobe at the base and only a slight concavity above it (see fig. 73, p. 252).

Muzzle blunt, glandular swellings on the sides well developed, the face behind them depressed; crown of the head and forehead between the eyes thickly furred; muzzle, extending back to the ears and including the eyes, almost naked in adults. Feet small. Wing-membrane from the base of the toes. Postscapular lobe well developed, rounded. Last rudimentary caudal vertebra free. Penis longer in proportion than in any other bat.

Upper inner incisor bifid, the small external cusp placed slightly posteriorly, often difficult to distinguish. Outer incisor nearly as long as the inner and exceeding the outer cusp of the latter in length. The second upper premolar separated from the canine by a slight interval.

Colour of fur dark brown above, a little paler below; head and neck often with a yellowish tinge. All the basal portion of the hairs, frequently amounting to three fourths of their length, black.

Dimensions. Head and body 1·8 inches, tail 1·4, ear from crown 0·3, forearm 1·3.

Distribution. This is perhaps the commonest bat in India, and appears to be found throughout the Peninsula, Ceylon, and Burma. It ascends the Himalaya to at least 7000 feet, and is met with commonly in Sind and the Punjab. Beyond Indian limits it inhabits the whole Oriental region and a considerable part of the Palearctic, its range extending to Northern Australia in one direction, and, in the summer at all events, to Central Europe and even to Sweden in the other.

Habits. Probably one cause why this species is so frequently observed in India is that it is especially a house bat, hiding in roofs, outhouses, and old buildings during the day, rather than in woods, and flying early in the evening, often close to human habitations. It frequently comes into rooms at night. Its flight is very quick, but very irregular; after going a short distance it often drops suddenly, doubtless in order to seize an insect, and it frequently keeps about the same spot for a considerable time. I cannot say that it hibernates in India, but certainly this and other bats disappear almost entirely during the cold season from November to the end of February in Northern India. In temperate climates it is said to sleep throughout the winter. Blasius found two young in all pregnant females examined by him.

188. *Vesperugo pipistrellus.* *The common Pipistrelle.*

Vespertilio pipistrellus, Schreb. *Säugth.* i, p. 167, pl. 54 (1775).

Vespertilio pallidiventris, Hodgson, *Calc. Journ. N. H.* iv, p. 286 (no description; see Blyth, *J. A. S. B.* xx, p. 159, note).

Myotis pipistrellus, Blyth, *J. A. S. B.* xxi, p. 360; *id.* *Cat.* p. 35.

Vesperugo pipistrellus, Dobson, *Mon. As. Chir.* p. 95; *id.* *Cat. Chir. B. M.* p. 223; *id.* *Second Yarkand Miss., Mam.* p. 11; Anderson, *Cat.* p. 128; Scully, *P. Z. S.* 1881, p. 200; W. Blanford, *J. A. S. B.* lvii, pt. 2, p. 267.

Ears subtriangular, tip rounded, outer margin nearly straight for one third its length below the rounded tip, then suddenly curved out into a prominent lobe. There is a slight concavity opposite the base of the tragus, and in front of this a prominent convex lobe. Tragus very similar to that of *V. abramus*, but the inner margin is less concave. Muzzle better clad than in *V. abramus*.

Inner upper incisors bifid, the outer cusps smaller and posteriorly situated; each outer incisor sometimes as long as the outer cusp of the inner, sometimes shorter. In all other details of structure this bat agrees with *V. abramus*.

Colour of fur moderately deep rufous-brown above, paler below; basal half to three fourths of all hairs black. Specimens from dry sandy districts are paler, sometimes almost white below.

Dimensions. Head and body 1.65 inches, tail 1.4, ear from crown 0.3, forearm 1.25.

Distribution. The Palearctic region, generally distributed. Within Indian limits this species has only been recorded with certainty from Gilgit, and the valley of Kashmir.

Habits. Very similar to those of *V. abramus*. Like that species, the common pipistrelle is very often seen about human habitations, and it has the same rapid flight with frequent very quick turns and descents. It is said to live chiefly on gnats, and may be seen hawking them on summer evenings. During the day it hides in crevices of walls, clefts of rocks, or any dry protected hole, less frequently in trees. It appears early in the spring, and is sometimes found abroad on warm days in the winter, and it is usually the first bat to appear in the afternoon. The female bears sometimes one, sometimes two young.

189. *Vesperugo kuhlii*. *The white-bordered Bat.*

Vespertilio kuhlii, *Natterer, Kuhl, Deutsche Flederm.* p. 55 (1817).

Pipistrellus lepidus, *Blyth, J. A. S. B.* xiv, p. 340 (1845).

Nycticejus canus, *Blyth, Cat.* p. 32; *Jerdon, Mam.* p. 38.

Scotophilus lobatus, *Jerdon, l. c.* p. 35 (? *Gray, List Mam. B. M.* p. 29).

Vesperugo (*Pipistrellus*) *leucotis*, *Dobson, J. A. S. B.* xli, pt. 2, p. 222.

Vesperugo kuhlii, *Dobson, Mon. As. Chir.* p. 94; *id. Cat. Chir. B. M.*

p. 230; *id. J. A. S. B.* xli, pt. 2, p. 311; *Anderson, Cat.* p. 131;

Scully, A. M. N. H. ser. 5, vol. viii, p. 223 (1881); *W. Blanf. J.*

A. S. B. lvii, pt. 2, p. 267.



Fig. 95.—Head of *V. kuhlii*. (*Dobson, Mon. As. Chir.*)

Ears larger than in *V. abramus*, extending when laid forward more than halfway between the eye and the nostril, subtriangular; tips rounded; outer margins nearly straight, slightly concave just below the tip, with a small emargination opposite the base of the tragus, and a not very prominent lobe (much less convex than in *V. abramus*) at the end behind the angle of the mouth. Inner margin nearly straight. Tragus rounded at the tip, broadest below the middle of the inner margin, which is straight; outer margin convex, especially in the middle, and having a small pointed lobe at the base.

In other details of structure (except in the teeth) there is no important difference from *V. abramus*. The outer upper incisors are very short, only about one fourth the length of the inner, which are long and pointed, not bifid.

Colour of fur yellowish or greyish brown above, paler, often whitish, below, the basal two thirds to three fourths of the hairs black, both above and below. Some specimens are much darker than others. Membranes and ears usually dark, the hinder border of the interfemoral and wing-membranes more or less bordered with white. In specimens from Cutch, Sind, Baluchistan (*Pipistrellus lepidus*, *Blyth, P. leucotis*, *Dobson*), and the neighbouring countries the tips of the fur are light yellowish brown, the ears, interfemoral and antebrachial membranes, and wing-membrane near the sides of the body are white, and the remainder of the wing-membrane traversed by white reticulations.

Dimensions. Head and body 1·75 inches, tail 1·5, ear from crown 0·4, forearm 1·4.

Distribution. Europe south of the Alps, Northern Africa, and Southern Asia. In India this species is widely, perhaps generally distributed, being common in Sind, the Punjab, and the neighbouring countries, and recorded from several parts of the Behgal and Madras Presidencies. It has not been hitherto noticed east of Cachar, nor obtained from the Himalayas nor from Ceylon.

Habits. The flight is not unlike that of *V. abramus*, but less rapid and with rather fewer sudden turns. The female has been found, both in Europe and India, to have two young at a birth.

190. *Vesperugo annectens.* *The intermediate Bat.*

Pipistrellus annectans, Dobson, *F. A. S. B.* 1871, p. 213.

Vesperugo annectens, Dobson, *Mon. As. Chir.* p. 116; *id. Cat. Chir.*

B. M. p. 234; Anderson, *Cat.* p. 132.



Fig. 96.—Head of *Vesperugo annectens*. (Dobson, *Mon. As. Chir.*)

Ears bluntly pointed, the tips rounded, outer margin hollowed out immediately below the tip, then convex, again slightly concave opposite the base of the tragus, and terminating in a small rounded lobe. Tragus long, subacutely pointed, inner margin almost straight, outer slightly convex, with a small rounded lobe at the base.

Head slightly elevated; the fur covers the whole face except the nostrils, and forms a thick fringe to the upper lip; the glandular prominences on the side of the muzzle are small, they and the sides of the face are less thickly covered with hair than the upper surface. No postcalcaral lobe; extreme tip of tail free.

Upper incisors nearly equal, the inner pair slightly notched at the extremity. First upper premolar minute, placed slightly inside the tooth-row, but distinctly visible from without.

Colour of fur, so far as can be ascertained from a specimen in spirit, dark brown above with paler tips; beneath brown, the tips reddish.

Dimensions. Head and body 2 inches, tail 1·6, ear from base of outer margin 0·6, forearm 1·8.

Distribution. Naga hills, Assam. The only specimen obtained is in the Indian Museum, Calcutta. A skin, probably belonging to the same species, is amongst Mr. Hodgson's Nepal collections in the British Museum.

This species has the dentition of *Vesperugo* and the hairy face, the ear, and tragus of *Vespertilio*. The above is Dobson's description, slightly abridged.

191. *Vesperugo tickelli*. *Tickell's Bat*.

Nycticejus tickelli, Blyth, *J. A. S. B.* xx, p. 157 (1851); *id.* *Cat.* p. 31; *Kelaart, Prod.* p. 24.

Nycticejus isabellinus, Blyth, *Horsfield Cat.* p. 38 (no description).

Vesperugo tickelli, Dobson, *Mon. As. Chir.* p. 113; *id.* *Cat. Chir. B. M.* p. 240; *id.* *J. A. S. B.* xlv, pt. 2, p. 312; *Anderson, Cat.* p. 132.

Ears oval, rounded at the tips, extending when laid forwards to about halfway between the eye and the nostril; outer margin concave opposite the base of the tragus, and terminating in a rounded thickened lobe behind the angle of the mouth. Tragus lunate, curved forward, bluntly pointed, inner margin concave, outer very convex with a small lobe at the base.



Fig. 97.—Head of *Vesperugo tickelli*. (Dobson, *Mon. As. Chir.*)

Muzzle blunt, swollen at the sides, slightly depressed above in the middle. Wings from the base of the toes. A distinct post-calcaneal lobe; tail long, only the tip free. The fur extends forward on the middle of the face far in front of the eyes; sides of face including the eyes and extending to the ears, together with the terminal portion of the face, nearly naked.

Inner upper incisors large, unicuspidate, and situated near the canines, the outer incisors small, each placed behind the inner, in the angle between it and the canine. Thus on looking into the mouth only two upper incisors are seen, the small outer incisors looking like their basal cusps. No anterior upper premolar.

Colour of fur light greyish brown above, generally with a rufous tinge on the lower back; hairs, except the rufous tips, of the same colour throughout; below buff. Membranes dusky, paler along the digits and on the interfemoral.

Dimensions. Head and body 2·6 inches, tail 2, ear from crown 0·4, forearm 2·1.

Distribution. Peninsula of India (Nusseerabad in Rajputana; Bombay; Chybassa, Jashpur, Sirguja in S.W. Bengal), Ceylon; Andaman Islands, and near Moulmein in Burma.

192. *Vesperugo blanfordi*. *Limborg's Bat*.

Vesperugo (*Hesperoptenus*) *blanfordi*, Dobson, *J. A. S. B.* xlv, pt. 2, p. 312; *id.* *Cat. Chir. B. M.* p. 242; *Anderson, Cat.* p. 133.

Ears short, subtriangular, tips broadly rounded, upper half of

outer margins straight, then convex, slightly concave opposite the base of the tragus, and terminating abruptly in a deep lobe closer to the angle of the mouth than to the base of the tragus; tragus narrowest opposite to the base of its inner margin, expanded above and curved inwards.

Head very flat and broad; nostrils wide apart, semilunate. Feet very small, the sole of the feet forming a cushion, probably adhesive, but not expanded as in *V. pachypus*. Postcalcaneal lobe very large, broader than the foot, and with a median cartilaginous support, the extreme tip of the tail alone projecting. In all other details, this species, though less than half the size, exactly resembles *V. tickelli*, and the dentition is similar, the outer incisors being proportionally even smaller and placed more behind the inner.

Colour of fur dark reddish brown above, slightly paler beneath.

Dimensions. Head and body 1.75 inches, tail 1.1, ear from base of outer margin 0.45, forearm 1.1.

Distribution. The type was obtained by Mr. Limborg east of Moulmein in Burmah, together with *V. tickelli*; another specimen has been found at Johore in the Malay Peninsula.

Genus **NYCTICEJUS**, Rafinesque (1819).

Syn. *Scotophilus*, Leach (1822).

Head short and broad; ears far apart, usually short, rounded at the tips, generally with the basal lobe of the inner margin well developed and its inner termination free; tragus well developed; muzzle broad and swollen, nearly naked; nostrils near together, opening by simple lunate apertures in front or sublaterally.

Membranes thick and leathery, as a rule quite naked, the fur confined to the body. Wing-membranes from the base of the toes. Limbs stout. Tail long, but shorter than the head and body.

Dentition: i. $\frac{1-1}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{1-1}{2-2}$ or $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Four upper milk-incisors. Upper incisors long, unicuspidate, with their bases usually

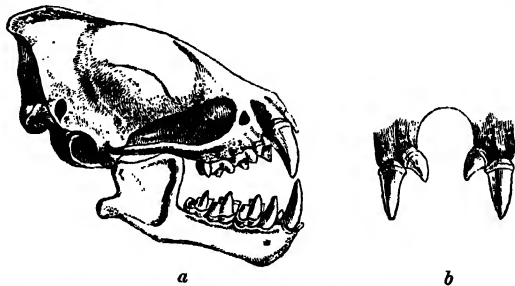


Fig. 98.—a, Skull of *Nycticejus kuhli*. b, Upper canine and incisor teeth.

close to those of the canines. Upper premolar (or second, if there are two) large, exceeding the molars in height, close to the canine. Last upper molar small.

The genus ranges throughout the Ethiopian and Oriental regions and extends to Australia on one side, and to N. America on the other. Mr. Thomas has recently shown (Ann. Mus. Civ. Genova, ser. 2 a, ix, p. 88) that the genera *Scotophilus* and *Nycticejus* must be reunited.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Two upper premolars on each side; forearm 1.4 *N. dormeri*, p. 319.
- B. One upper premolar on each side.
 - a. Basal lobe of ear angular; tragus with a prominent rib across front surface; forearm 1.9 to 2.7 inches *N. kuhli*, p. 320.
 - b. Basal lobe rounded; tragus without rib.
 - a'. Fur without white spots.
 - a''. Basal lobe of ear terminating internally in a rounded free lobule in front of tragus; forearm 2.2 *N. emarginatus*, p. 321.
 - b''. Basal lobe rounded, not produced internally; forearm 1.4 *N. pallidus*, p. 322.
 - b'. Fur with white spots; forearm 2.3 *N. ornatus*, p. 322.

193. *Nycticejus dormeri*. *Dormer's Bat*.

Scotozous dormeri, Dobson, P. Z. S. 1875, p. 373.

Vesperugo dormeri, Dobson, Mon. As. Chir. p. 118; id. Cat. Chir. B. M. p. 243.

Ears subtriangular, tips rounded, margins below the tips nearly straight, inner margin slightly emarginate at the base, but without any distinct basal lobe; outer margin concave opposite the base of the tragus, and ending in a rounded lobe. Tragus straight, pointed, a small lobe at the base of the outer margin, the two margins nearly parallel for some distance, but the terminal third of the outer margin slopes inwards and meets the inner margin at an acute angle.

Muzzle blunt without any median depression above, glands at side swollen; face in front of eyes, and comprising the area around the eyes, almost naked; nostrils opening sublaterally. Postcalcaral lobe distinct. Tip of the tail projecting.

A single large unicuspidate upper incisor on each side close to the canine directed forward and inward. Lower incisors crowded, middle pair larger than the others, all distinctly trifid. Two upper premolars, first very minute, second large, not quite close to the canine. First lower premolar broader, but shorter than the second.

Colour of fur above dark brown with ashy tips, below dirty white, the basal portion of the hairs very dark brown.

Dimensions. Head and body about 1.75 inches, tail about 1.25 forearm 1.4.

Distribution. The Peninsula of India. The type specimen was found near Bellary, and I obtained two individuals in South-east Berar, near Chanda.

This species has generally been placed in *Vesperugo*, and is intermediate in character between that genus and *Nycticejus*.

94. *Nycticejus kuhli*. *The common yellow Bat.*

- Scotophilus kuhlii*, *Leach, Tr. L. S. xiii*, p. 72 (1822); *W. Blanf. J. A. S. B. lvii*, pt. 2, p. 267.
Vespertilio temminckii, *Horsf. Res. Java* (1824).
Nycticejus heathii, *Horsf. P. Z. S. 1831*, p. 113.
Vespertilio belangeri (and *V. noctulinus*?), *Is. Geoffr. Bélanger, Voy Ind. Or.* pp. 87, 92, pl. 3 (1834).
Scotophilus temminckii, *Cantor, J. A. S. B. xv*, p. 185; *Dobson, P. Z. S. 1875*, p. 370; *id. Mon. As. Chir.* p. 120; *id. Cat. Chir. B. M.* p. 258; *Anderson, Cat. B.* 133.
Nycticejus heathii, *N. belangeri*, and *N. luteus*, *Blyth, J. A. S. B. xx*, p. 157.
Nycticejus temminckii, *N. flaveolus*, and *N. castaneus*, *Horsf. Cat.* pp. 37, 38.
Nycticejus heathii and *N. belangeri*, *Kelaart, Prod.* p. 23.
Nycticejus temminckii, *Blyth, J. A. S. B. xxi*, p. 345.
Nycticejus heathii, *N. luteus*, *N. temminckii*, and *N. castaneus*, *Blyth, Cat.* pp. 30, 31; *Jerdon, Mam.* pp. 37, 38.
Nycticejus luteus, *Hutton, P. Z. S. 1872*, p. 700.

Ears short, extending but little in front of the eyes when laid forward, subtriangular, the tips rounded, outer margin below tip nearly straight, deeply notched opposite the base of the tragus and terminating in a very convex lobe; upper half of inner margin of ear-conch slightly convex, then there is a blunt obtuse angle, and



Fig. 99.—Head of *N. kuhli*.
 (Dobson, *Mon. As. Chir.*)

the lower half is straight; at the base the margin turns by another obtuse angle into the straight-edged basal lobe, the inner termination of which is free and pointed. Tragus long, narrow and attenuate towards the slightly rounded tip, much curved forward and inward; inner margin concave, outer convex with a small lobe at the base; from the base of the inner margin a narrow prominent rib passes across the front surface, sloping somewhat upwards.

Muzzle thick; head broad; face nearly or quite flat, no depression behind the muzzle or in the middle. Postcalcarial lobe narrow. Only the extremity of the tail projecting. The fur is short.

Skull thick, with prominent crests; the anterior surface slopes evenly down from the occiput to the nose. Upper incisors close to the canines, the bases of the teeth in contact; there is a distinct but not large expansion behind the base of each upper incisor, forming a cingulum. One upper premolar. First lower premolar small, appearing as if compressed between the canine and second premolar, which is higher than the molars (fig. 98, p. 318).

Colour of fur variable, generally yellowish brown above, the basal portion of the hairs paler, dull buff or yellowish grey below. The colour of the upper surface, however, varies to deep or bright chestnut, golden brown, or to greyish brown, whilst the lower parts are yellow or dirty white.

Dimensions very variable. In a specimen of ordinary size the

head and body are 3 inches long, tail 2, forearm 2·1, ear from crown 0·35. In some adults the forearm is less than 2 inches. But large individuals occur, both males and females, with a forearm from 2·4 to 2·7. These have generally been separated as a distinct species, under the name of *N. heathi*, but Dobson has classed them as a variety. I cannot but think he is right, though certainly the difference is very remarkable.

Distribution. The whole Oriental region from Sind to Borneo and the Philippines. Common nearly throughout India, Ceylon, Assam, and Burma, but, I think, less abundant in forest-regions than in cultivated tracts. This species is said by Hutton to occur at low elevations not exceeding about 3000 feet on the Western Himalayas. I cannot find it recorded from Nepal or Sikhim.

Habits. Not only is this bat very common throughout India, but it is one of the first to appear in the evening, so that it is seldom wanting in any collection of Indian *Chiroptera*. It flies more slowly and steadily than the species of *Vesperugo* in general. In the day-time it has been found by Hutton singly, in pairs, or in small parties of five or six in outhouses, sheds, verandahs, temples, &c. In Java, according to Horsfield, it collects by hundreds in the trunks and hollows of trees, and feeds chiefly on "white ants."

Mr. Oldfield Thomas has recently ascertained that the immature type of *Scotophilus kuhlii* in the British Museum undoubtedly belongs to the present species.

195. *Nycticejus emarginatus*. The large-eared yellow Bat.

Nycticejus emarginatus, Dobson, *P. A. S. B.* 1871, p. 211.

Scotophilus emarginatus, Dobson, *Mon. As. Chir.* p. 123; *id. Cat.*

Chir. B. M. p. 262; *Anderson, Cat.* p. 136.

Ears large, with broadly rounded tips; inner margin convex, with a rounded lobe at the base, passing in front of the inner margin of the tragus and resting on part of its anterior surface; outer margin abruptly emarginate below the tip, ending below in a rounded lobe; tragus moderately long, without any ridge on the front surface, slightly curved inwards and obtusely pointed, maintaining almost the same breadth from the base to within a short distance from the tip, above this there is a rapid diminution in the width.

Head broad and flat; muzzle thick and obtuse; glands of the upper lip largely developed, forming rounded prominences between the nostrils and eyes. Last tail-vertebra free. Fur short and close.

Colour of fur throughout at the base dark ferruginous brown, then buff, on the upper parts alone yellowish-brown tips are added.

Dimensions. Head and body 2·9 inches, tail 2·2, ear (from base of outer margin) 0·85, forearm 2·2.

Distribution. The only known specimen, the type in the Indian Museum, Calcutta, is from an unknown locality in India. The above description is slightly abridged from Dobson's.

196. *Nycticejus pallidus*. *The desert yellow Bat.*

Scotophilus pallidus, Dobson, *Mon. As. Chir.* p. 186; *id. Cat. Chir. B. M.* p. 264; *id. J. A. S. B.* xvi, pt. 2, p. 310; *Anderson, Cat.* p. 137.

Ears thick and short, tips broadly rounded, margins convex, basal lobe round; outer margin emarginate opposite base of tragus and ending in a convex lobe; tragus moderately long, not attenuate, rounded at the tip, inner margin straight or slightly concave, outer moderately convex, with a prominent pointed lobe at the base.

Muzzle and teeth as in *N. kuhli*. Tip of the tail free.

Colour of fur above light chestnut-brown, beneath brownish buff, basal portion of hairs on both surfaces pale buff. In some specimens the fur and membranes are all pale buff throughout.

Dimensions. Head and body 2 inches, tail 1·4, ear from crown 0·35, forearm 1·4.

Distribution. Sind and the Punjab.

197. *Nycticejus ornatus*. *The harlequin Bat.*

Nycticejus ornatus, Blyth, *J. A. S. B.* xx, pp. 159, 517, xxvi, p. 285; *id. Cat.* p. 30; *Jerdon, Mam.* p. 39.

Nycticejus nivicolus, Hodgson, *Horsfield, A. M. N. H.* (2) xvi, 1855, p. 104; *Jerdon, l. c.* p. 39.

Scotophilus ornatus, Dobson, *P. Z. S.* 1875, p. 371; *id. Mon. As. Chir.* p. 124; *id. Cat. Chir. B. M.* p. 265; *Anderson, An. Zool. Res.* p. 99; *id. Cat.* p. 137; *W. Blanford, J. A. S. B.* lvii, pt. 2, p. 268.

Ears of moderate size, subtriangular, with rounded tips; outer margin slightly concave below the tip, then convex, emarginate opposite the base of the tragus and ending in a rounded lobe; inner margin slightly convex above, ending in a well-rounded basal lobe, the free inner extremity of which is a rounded point. Tragus long, bluntly pointed, inner margin nearly straight, becoming concave above, outer margin convex, ending in a pointed projecting lobe at the base.

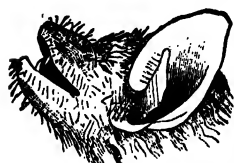


Fig. 100.—Head of *N. ornatus*. (Dobson, *Mon. As. Chir.*)

Muzzle broad, much swollen, nearly naked; the swollen terminal naked portion stands out abruptly, above and at the sides, just in front of the eyes, from the hinder part of the face, which is covered above with long hair; sides of the face thinly clad. The fur generally softer and longer than in *N. kuhli*. Tail long, only the tip free.

The premaxillary bones are more developed than in *N. kuhli*, and the incisors are separated from the canines by a space, even at the base.

Colour of fur brownish yellow above, almost orange-brown, with some white spots; the hairs dark brown at the base, then isabelline, the tips brownish yellow. A small elongate patch of pure white on the crown of the head; a narrow white stripe down the middle of the back (this is said to be interrupted in some specimens), and

two spots, just above the wing-membrane, behind each shoulder. In front of each shoulder is the termination of a broad white V-shaped band extending to the abdomen; there is another white band forming a collar commencing beneath each ear and running forward to the chin. Remainder of the lower parts brown. The size of the white patches varies, being larger in males; in females the markings are much less distinct. The limbs and digits and a variable portion of the membranes are sometimes tawny red.

Dimensions. Head and body 3·1 inches, tail 2·5, ear from crown 0·55, forearm 2·3.

Distribution. The Eastern Himalayas, Khási hills, and some of the ranges of Upper Burma and Yunnan. According to Jerdon, this bat inhabits warm valleys near Darjiling, whilst Hodgson's *Nycticejus nivicolus*, which an examination of Hodgson's drawings in the British Museum shows to be the same, is said to be from the northern region of the Sikhim Himalaya near the snows. Jerdon's account is doubtless correct; some of Hodgson's specimens from the interior of the hills, although obtained near high mountains, were from the deep valleys at low elevations above the sea.

Genus **HARPYIOCEPHALUS**, Gray (1842).

Syn. *Murina*, Gray (1842):

Muzzle elongate, but varying in breadth, crown of the head scarcely raised above the face-line. Nostrils prominent, tubular, produced beyond the upper lip, with a circular orifice opening more

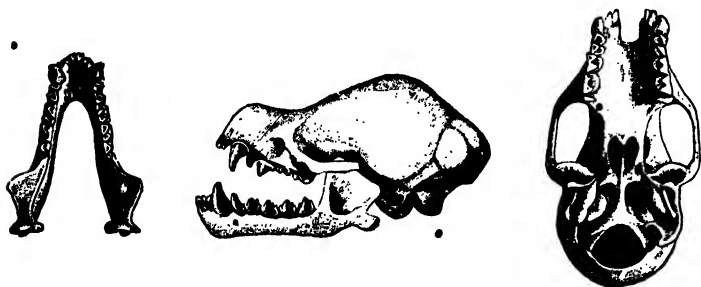


Fig. 101.—Skull of *Harpyiocephalus cyclotis*, $\times 2$. (Dobson, Mon. As. Chir.)

or less laterally, the outer margin cleft; end of the nose between the nostrils concave. Ears thin, generally covered with glandular papillæ; tragus long, attenuate towards the tip, and inclined outwards. Thumb very large, with a large strongly curved claw. Wings broad, interfemoral membrane much covered with hair above.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Upper incisors on each side parallel and stout; posterior upper molar small, sometimes absent in the adult.

This genus may be recognized by the peculiar tubular nostrils. The species range from Tibet and Gilgit to Ceylon and the Malay Archipelago, keeping to the hill-tracts.

*Synopsis of Indian, Ceylonese, and Burmese Species *.*

- A. Upper third of outer margin of ear-conch
concave or emarginate.
- a. First upper premolar not so high as second ;
forearm 1·4 inches *H. tubinaris*, p. 324.
- b. First and second upper premolars equal in
height.
- a'. Ears narrow, pointed ; forearm 1·3.... *H. griseus*, p. 325.
- b'. Ears broadly rounded off above ; fore-
arm 2 *H. harpyia*, p. 325.
- B. Upper third of outer margin of ear-conch
convex or straight.
- a. Colour ferruginous red above ; forearm 1·3. *H. cyclotis*, p. 326.
- b. Colour brown above ; forearm 1·3 *H. leucogaster*, p. 327.

I am unable to concur in the reasons which induced Dobson and Peters to prefer *Harpyiocephalus* to *Murina*, both names having been proposed in the same paper ; but it appears to me better to continue the use of the first term now that it has, through Dobson's important monographs, obtained general acceptance.

198. *Harpyiocephalus tubinaris*. *Scully's tube-nosed Bat*.

Harpyiocephalus tubinaris, *Scully*, *P. Z. S.* 1881, p. 200.

Muzzle narrow, elongate, hairy. Ears moderate, rounded off at the tips ; the outer margin is slightly emarginate in its upper third, then moderately convex, again slightly convex opposite the middle of the tragus, and it terminates in a convex lobe in front of the base of the tragus ; inner margin convex, with a distinct spur-like process projecting near the base. Tragus moderately long, tapering above, where it curves outwards ; a small pointed lobule above the base of the outer margin, succeeded by a well-marked emargination ; above this the tragus attains its greatest breadth, outer margin above this straight at first, the upper half concave ; inner margin nearly straight at the base, the upper two thirds concave.

Wings from the side of the proximal phalanx of the outer toe ; extreme tip of tail projecting. Interfemoral membrane naked above except at the base between the thighs ; wing-membranes clothed close to the body.

Outer upper incisor distinctly shorter than the inner. First upper premolar shorter than the second, which is nearly as high as the canine ; last molar a simple transverse plate.

* Mr. O. Thomas has just found, he informs me, amongst Mr. Fes's collections from Karennee, a new *Harpyiocephalus* allied to *H. auratus* from Eastern Tibet. A description will be published in the *Annali Mus. Civ. Genova*, ser. 2a, vol. x.

Colour of fur greyish brown above, white below; the basal half of the hairs blackish brown above, dusky beneath.

Dimensions. Head and body 1·8 inches, tail 1·4, forearm 1·4.

Distribution. The only specimen hitherto recorded was obtained by the describer Dr. J. Scully at Gilgit.

This species is allied to the Malay *H. suillus*, but differs in the ear being less emarginate and furnished with a basal spur, in colour, &c.

199. *Harpyiocephalus griseus*. *Hutton's tube-nosed Bat*.

Murina grisea, Hutton, *P. Z. S.* 1872, p. 712.

Harpyiocephalus griseus, Dobson, *Mon. As. Chir.* p. 154; *id. Cat. Chir. B. M.* p. 280.

Head conical, muzzle narrow, hairy. Ears small, narrow, bluntly pointed, with narrowly rounded tips, upper third of the outer margin angularly emarginate, middle third convex, lower straight, ending opposite the base of the tragus, which is pointed and slightly curved outwards.

Wings from the base of the toes. Extreme tip of tail only free. Interfemoral membrane densely covered above with rather long hair, which, however, thins out towards the posterior margin.

Upper incisors large, conical, nearly as long as the canine, the inner slightly the larger and having a short posterior blunt cusp arising from the cingulum. Upper premolars equal to each other and to the canine in height. Lower canine short.

Colour above dark brown, with the ends of the hairs yellowish brown; below similar, but the tips are ashy grey.

Dimensions. Head and body 1·4 inches, tail 1·1 (according to Hutton 2 inches and 1), ear outside 0·3, forearm 1·35.

Distribution. The only specimen known was taken at an elevation of 5500 feet by Captain Hutton at Jeripani near Mussoorie in the N.W. Himalayas.

200. *Harpyiocephalus harpyia*. *The hairy-winged Bat*.

Vespertilio harpia, Temminck, *Mon. Mam.* ii, p. 219, pl. 55, figs. 5, 6 (1835-41).

Noctilinia lasyura, Hodgson, *J. A. S. B.* xvi, p. 896 (1847).

Lasiurus pearsonii, Horsfield, *Cat.* p. 36; Blyth, *J. A. S. B.* xx, p. 524; Jerdon, *Mam.* p. 40.

Vespertilio pearsonii, Tomes, *P. Z. S.* 1858, p. 87; Blyth, *Cat.* p. 34.

Murina harpia, Dobson, *P. A. S. B.* 1873, p. 109.

Harpyiocephalus harpia, Dobson, *Mon. As. Chir.* p. 155; *id. Cat. Chir. B. M.* p. 281; Anderson, *Cat.* p. 138.

Muzzle thick and blunt, thinly clad in front of the eyes and on the sides of the head. Ear-conch nearly as broad as long, broadly rounded at the tip, outer margin straight below the tip, then slightly emarginate, convex in the middle, again emarginate opposite the base of the inner margin, and terminating in a small lobe in front of the tragus. Inner margin very convex below the

middle. Tragus moderately long, slender, attenuated, broadest opposite the base of the inner margin, whence the outer margin slopes rapidly downwards and inwards to the small basal lobe, and gently upwards to the subacutely pointed tip; inner margin straight or very slightly convex throughout.



Fig. 102.—Head of *H. harpyia*. (Dobson, Cat. Chir. B. M.)

Wings from the base of the toes. The fur is long, soft, and silky, and extends over the whole upper surface of the interfemoral membrane, the legs, and the wing-membrane as far as beyond a line drawn from the middle of the humerus to the outer toe, being very dense upon the calcanea and backs of the feet. Beneath, the interfemoral membrane bears only a few short scattered hairs. Inner side of ear-conch thinly clad with short fine hair.

Outer upper incisors shorter than the inner; upper preinfolars subequal, third upper molar deciduous, often wanting. All the teeth very thick and strong, with blunt cusps.

Colour of fur above brownish grey with a ferruginous tinge, hairs with white tips being intermixed on the head, neck, and shoulders; hair of lower back, interfemoral and wing-membranes deep bay. Lower surface of body grey.

Dimensions. Head and body 2.5 inches, tail 2, forearm 2, ear outside from head 0.4.

Distribution. Found at Darjiling and on the Khási hills, also in Sumatra, Java, and Amboyna. A specimen in the British Museum labelled Malabar Coast may be from the hill-range of the Western Gháts. Probably this handsome bat is widely distributed in the hill-tracts of India and Burma.

Habits. Nothing is known except that fragments of the elytra of beetles have been found in the stomach, and that the teeth appear well suited for crushing the hard cases of Coleoptera. Dobson suggests that *H. harpyia* may feed on beetles with very solid wing-cases.

201. *Harpyiocephalus cyclotis*. The round-eared tube-nosed Bat.

Murina suilla, Blyth, Cat. p. 34; *Jerdon, Mam.* p. 41; *nec Vespertilio suillus*, Temm.

Murina cyclotis, Dobson, P. A. S. B. 1872, p. 210; *id. J. A. S. B.* xlii, pt. 2, pl. xiv, fig. 14.

Harpyiocephalus cyclotis, Dobson, Mon. As. Chir. p. 158; *id. Cat. Chir. B. M.* p. 282; *Anderson, Cat.* p. 139.

Muzzle thick. Ears almost circular, margins convex throughout; there is a small blunt projection to the basal lobe of the inner margin, very different from the pointed spur of *H. leucogaster*. Tragus narrow at the base, then broader, being widest just above

the base of the inner margin, thence gradually tapering to the end, which is finely subacutely pointed, the inner margin slightly convex throughout, outer straight below the widest part of the tragus, then angulate, concave above.



Fig. 103.—Ear of *H. cyclotis*. (Dobson, Mon. As. Chir.)

Wing-membrane from the base of the claw on the outer toe; feet small; only the extreme tip of the tail free. Interfemoral membrane hairy above, hair densest at the root of the tail, along the tibiae and calcanea. Backs of the feet also thickly furred.

Upper incisors long and slender, the outer the shorter. First and second upper premolars subequal, the first a little the smaller, and about half as high as the canine.

Colour of fur above dark brown with ferruginous, or sometimes with yellowish-brown tips, below paler brown.

Dimensions. Head and body 1·7 inches, tail 1·5, forearm 1·3, ear from crown outside 0·37.

Distribution. A purchased specimen in the British Museum is said, apparently on fair authority, to be from Ceylon. All the other known examples are from the Sikhim Himalayas.

202. *Harpyiocephalus leucogaster*. *The white-bellied tube-nosed Bat.*

Murina leucogaster, A. Milne-Edwards, *Nouv. Arch. Mus.* vii, Bull. p. 91 (1871); *Rech. Mam.* p. 252, pl. xxxvii B, fig. 2, xxxvii C, fig. 3.

Harpyiocephalus huttonii, Peters, *P. Z. S.* 1872, p. 711.

Harpyiocephalus leucogaster, Dobson, *Mon. As. Chir.* p. 157; *id. Cat. Chir. B. M.* p. 283; Scully, *J. A. S. B.* lvi, pt. 2, p. 251.

Muzzle thick. Ears oval with convex margins; near the base of the inner margin a small pointed process projects, Tragus attenuated above, pointed and curved outwards, an obtuse lobule just above the base of the outer margin.

Wings from base of claw on outer toe. Fur long and dense. Interfemoral membrane hairy above as in *H. cyclotis*.

Outer upper incisors larger than the inner; first upper premolar smaller than the second, and situated a little inside the general line of the teeth.

Colour of fur above brown, not dark, the hair greyish at the base; beneath, the throat, chest, and abdomen are whitish, the sides of the body pale brown.

Dimensions. Head and body 1·9 inches, tail 1·5, forearm 1·3, ear from crown of head 0·4.

Distribution. This species was obtained by Hutton at Jeripani near Mussoorie, Scully captured it in Nepal, and there is a skin procured by Hodgson at Darjiling in the British Museum. The original type was from Eastern Tibet.

Habits. According to Hutton, this bat when searching for

insects, "skims closely and somewhat leisurely over the surface of the crops and grass." One that entered a room kept low down near the floor, instead of flying about the ceiling as most bats do.

Two other species of the genus, *H. suillus* found in the Malay Archipelago, and *H. auratus* from Eastern Tibet, may hereafter be found within Indian limits. Both are small forms with a narrow muzzle.

Genus **VESPERTILIO**, L. (1766).

Syn. *Trilatulus*, *Myotis*, Gray.

Muzzle long, face hairy; the glandular prominences on each side between the eye and the nostril much less developed than in *Vesperugo*, and scarcely increasing the breadth of the face; nostrils not prolonged, opening sublaterally by crescentic apertures; crown of the head but slightly raised above the face. Ears separate, longer than broad, generally longer than in *Vesperugo*, the internal

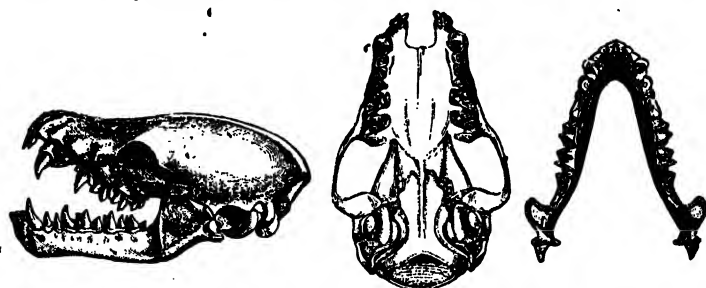


Fig. 104.—Skull of *Vespertilio*, enlarged. (Blasius, Säugeth. Deutschlands.)

basal lobe angular, the external margin of the ear-conch terminating below the base of the tragus or very slightly in front, and not carried far forward towards the angle of the mouth. Tragus long, generally attenuated above and pointed.

Tail less than the head and body (rarely equal); postcalcaral lobe absent or very small.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$. The upper incisors subequal, in pairs on each side close to the canines, the points of the teeth in each pair generally diverging in direction, the outer incisor pointing slightly outwards, the inner inwards; lower outer incisors much larger than the inner. The first and second upper premolars small, the second always smaller than the first, often minute and internal to the tooth-row. The relative proportions of the three lower premolars are the same, the second being the smallest, but it is rarely so minute as the corresponding tooth in the upper jaw. The last upper molar is rather less in section than half the next.

The genus *Vespertilio*, as at present restricted, ranges throughout

nearly all tropical and temperate regions in both hemispheres, and has consequently a wider distribution than any other genus of *Chiroptera*. The species are recognized by the narrow hairy muzzle, the long oval ear, the narrow elongate tragus, and the numerous teeth. The members of this genus are, as a whole, more susceptible to cold than those belonging to *Vesperugo*, and are consequently less numerously represented in the colder parts of the temperate zone. They also appear later in the spring after hibernation.

The species of *Vespertilio* are difficult to classify and distinguish. Those with larger feet free from the wing are said to be dwellers in caves, whilst the smaller-footed forms, with the wing-membranes from the base of the toes, live mainly in trees. But no definite line can be drawn in the case of either the characters or the habitat.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Foot large, measuring from wrist to end of claws more than $\frac{1}{2}$ length of forearm. Calcaneum extending fully $\frac{1}{2}$ the distance from ankle to tail.
 - a. Wings from ankles or a little above.
 - a'. Second premolar above and below minute, inside the tooth-row; forearm about 1.6 inches *V. hasselti*, p. 330.
 - b'. Second premolar in the tooth-row, visible from outside; forearm about 1.45.... *V. longipes*, p. 331.
 - b. Wings from side of foot immediately below ankle.
 - a'. Ears laid forward extend to end of nose; forearm about 1.45 *V. daubentoni*, p. 331.
 - b'. Ears extend beyond end of nose; forearm about 1.45 *V. megalopus*, p. 332.
- B. Foot moderate, less than $\frac{1}{2}$ the length of forearm. Calcaneum extending about half-way from ankle to tail.
 - a. Wings from side of foot, between ankle and base of toes.
 - a'. First upper premolar at least double second in height; forearm about 2.25 *V. murinus*, p. 334.
 - b'. Two anterior upper premolars subequal, both small; forearm about 2.2 *V. dobsoni*, p. 335.
 - b. Wings from base of outer toe.
 - a'. Wing-membranes particoloured orange and black; forearm about 1.9 *V. formosus*, p. 335.
 - b'. Wing-membranes the same colour throughout.
 - a''. No postcalcanal lobe.
 - a. Terminal half of fur on lower surface white; forearm about 1.35 *V. nipalensis*, p. 333.
 - β. Fur of lower surface dark brown with ashy tips; forearm about 1.35 *V. mystacinus*, p. 336.
 - b''. A postcalcanal lobe; forearm about 1.25 *V. muricola*, p. 337.

203. *Vespertilio hasselti*. *Van Hasselt's Bat.*

Vespertilio hasselti, *Temminck, Mon. Mam. ii*, p. 225, pl. lvi, figs. 7, 8 (1835-41); *Blyth, Mam. Birds Burma*, p. 23; *Dobson, Mon. As. Chir.* p. 126; *id. Cat. Chir. B. & M.* p. 291.

Muzzle blunt, glandular area between the eyes and the nostrils rather tumid, and face in front of the eyes almost naked. Ears short, laid forward each extends halfway between the eye and the nostril; tips broadly rounded, the outer margin straight from near the tip to opposite the base of the tragus; there a fold of the conch enters the margin and forms a small terminal convex lobe ending in front of the inner margin, which is convex throughout. Tragus moderately long, rather bluntly pointed, inner margin straight; outer slightly convex, with a triangular lobe at the base.



Fig. 105.—Ear of *V. hasselti*. (*Dobson, Cat. Chir. B. & M.*)

Wings from the ankles; calcaneum very long; feet very long and slender; interfemoral membrane forming an acute angle behind. Fur very short.

The second premolar in both jaws very minute and difficult to see, even with a lens; it is, both above and below, placed in the angle between the first and third premolar.

Colour of fur greyish brown above, dirty white below; all the basal portions of the hairs dark brown on both surfaces.

Dimensions. Head and body 2.1 inches, tail 1.75, ear outside from the crown 0.45, forearm 1.6.

Distribution. Malay Peninsula, Siam, Sumatra, Java, &c. A specimen from Burma, the exact locality not recorded, is in the British Museum.

Externally this species is a *Vesperugo*, and it was long referred to that genus, of which it has the nearly naked face and short ears, whilst the second lower premolar is much more minute than in any other *Vespertilio*. That the distinction of these genera by the dentition is artificial, especially when the teeth are mere rudiments, is shown by such instances as are afforded by the present form and by *Vesperugo annectens*.

V. adversus, Horsfield (not of Temminck), has an extensive range from Siam to South Australia, and may very possibly be found in Burma; indeed it is possible that it may be the *Myotis berdmorei* of Blyth (*Cat.* p. 35) from Schwe Gyeng. This species was, however, so imperfectly described (*J. A. S. B.* xxviii, p. 293), that as the specimens have unfortunately been lost, it is now impossible to identify it, and its being referred to *Myotis* suggests that it was more probably an ally of *V. mystacinus*. The bat called *V. adversus* by Temminck, Blyth, Cantor, Jerdon, and others was *V. muricola*.

The true *V. adversus* has a foot measuring 0.48 inch, wings from the ankles, a very long calcaneum, an oval ear without emargination, a moderately long pointed tragus with the inner margin

straight and the outer slightly convex, and an extremely small second upper premolar, quite inside the tooth-row; the second lower premolar, though small, being in the tooth-row. The coloration of the fur is very dark brown; the length of the forearm 1.5 inches.

204. *Vespertilio longipes*. *The Kashmir cave Bat.*

? *Myotis theobaldi*, Blyth, *J. A. S. B.* xxiv, p. 363; *id.* *Cat.* p. 36, note; Jerdon, *Mam.* p. 46.

Vespertilio macropus, Dobson, *P. A. S. B.* 1872, p. 209, *nec Gould*.

Vespertilio longipes, Dobson, *P. A. S. B.* 1873, p. 110; *id.* *Mon. As. Chir.* p. 131; *id.* *Cat. Chir. B. M.* p. 294; Anderson, *Cat.* p. 139; W. Blanford, *J. A. S. B.* lvii, pt. 2, p. 269.

Crown of head considerably raised; muzzle narrow, pointed, hairy; nostrils projecting slightly, and opening sublaterally with a hollow between them. Ears extending, when laid forward, to the end of the muzzle, narrow, tapering, the tips narrowly rounded off; upper half of the outer margin concave, lower half convex, inner convex throughout. Tragus long, slender, tapering towards the tip, which is rounded off; the outer margin has two small projecting lobes near the base.

Wings from the ankles. Feet very large, the toes forming more than half the length of the foot; the first and fifth toes shorter than the others. Face very hairy, and the upper lip clothed with long straight hairs.

The first and second upper premolars are both small, the second but slightly more internal in position than the first.

Colour of fur above black, below the same with whitish tips.

Dimensions. Head and body 1.75 inches, tail 1.45, forearm 1.45, foot 0.4.

Distribution. The types were obtained at the caves of Bhima Devi, Kashmir, elevation 6000 feet.

It is probable that *Myotis theobaldi*, obtained from caves near Matur Nag, N. of Islamabad, Kashmir, was the same as *V. longipes*, for the two agree in dimensions and both are characterized by large feet; but it is impossible to identify *Myotis theobaldi*, for the types have been lost, and it was said to be extremely close to the pipistrelle, from which *V. longipes* differs considerably in structure.

205. *Vespertilio daubentoni*. *The water Bat.*

Vespertilio daubentonii, Leisler, Kuhl, *Deutsche Flederm.* p. 51, pl. xxv, fig. 2 (1817); Dobson, *Mon. As. Chir.* p. 132; *id.* *Cat. Chir. B. M.* p. 297.

The ears laid forward extend nearly or quite to the nostril, tips rounded, not very broadly; inner margin regularly convex from base to tip; outer margin straight or slightly concave throughout

nearly the upper half, then abruptly convex. Tragus about half the length of the ear, subacutely pointed; inner margin quite straight, outer gently convex, with a distinct rounded lobe projecting just above the base.

Wings from the metatarsi; feet large; calcaneum long; last two vertebræ projecting from the interfemoral membrane. The face in front of the eyes half naked; glandular area between eyes and nostril rather tumid.

Upper incisors subequal in size, their cusps diverging widely. Second upper premolar in the tooth-row, fully visible from without, and about one third the height of the first.

Colour brown, usually snuff-brown above, dirty white below; basal half or more of all hairs dark brown.

Dimensions. Head and body 1·9 inches, tail 1·7, ear from crown of head 0·4, forearm 1·45.

Distribution. Throughout the greater part of the Palearctic region. This species has not been recorded from the Himalayas, but, strange to say, two specimens were obtained in Tenasserim by Mr. Limborg.

Habits. This bat in Europe is generally found near water, and, in the evening, flies about close to the surface of lakes, ponds, and rivers, and feeds upon the insects that are so common over water. It rests mainly on trees. It appears soon after sunset as a rule, and after hunting over water for a time returns to hang on a branch before it issues again in search of food.

206. *Vespertilio megalopus.* *The narrow-eared water Bat.*

Vespertilio megalopus, Dobson, *A. M. N. H.* (4) xvi, p. 261 (1875); *id. Cat. Chir. B. M.* p. 298.



Fig. 106.—Ear of *V. megalopus*. (Dobson, *Cat. Chir. B. M.*)

Very similar to *V. daubentoni*, but the ears are longer, much narrower, and more acute, and laid forwards extend beyond the end of the nose; the upper third of the inner margin of the ear-conch is straight instead of being convex, and the tip is narrowly rounded off. The tragus is longer, narrower, and quite obtuse, the upper third of its inner margin slightly concave, but the extremity is not directed inwards.

Wing-membrane from just below the ankle. The first and second premolars are proportionally smaller, and the second is more inside the tooth-row than in *V. daubentoni*.

Dimensions. Head and body 1·65 inches, tail 1·6, ear from crown 0·5, forearm 1·45.

Distribution. Kashmir. The collection containing this and other species was purchased by the British Museum and supposed at the time to be African, but it has since proved to be from Kashmir. The present is one of the few species included that has not been met with in other Kashmir collections.

207. *Vespertilio nipalensis*. *The Nepal Bat.*

Vespertilio pallidiventr, Hodgson, *Calc. Journ. N. H.* iv, p. 286 (1844) (name only).

Vespertilio nipalensis, Dobson, *N. A. S. B.* 1871, p. 214; *id. Mon. As. Chir.* p. 141; *id. Cat. Chir. B.M.* p. 302; Anderson, *Cat.* p. 140; Scully, *J. A. S. B.* lvi, pt. 2, p. 253.

Muzzle narrow, but with distinct half-naked glandular prominences between the eyes and nostrils. Ears not extending to the nostrils when laid forward, narrow and bluntly pointed; outer margin of the ear-conch hollowed out beneath the tip, which



Fig. 107.—Head of *Vespertilio nipalensis*. (Dobson, *Mon. As. Chir.*)

projects outwards considerably, lower half of outer margin convex, terminating, without any lobe, in front of the base of the tragus. The tragus is long, narrow, pointed, and curved slightly outwards; a small lobule at the base of the outer margin.

Wings from the base of the toes. Fur of the head and back dense and long, the long hair extending on the face to between the eyes.

The canines in both jaws very short, in the lower jaw resembling premolars; the first and second premolars are minute, and in the upper jaw scarcely distinguishable without the aid of a lens.

Colour of fur above black with brown tips; below pure white, the basal two thirds of the hair being black.

Dimensions. Head and body 1.65 inches, tail 1.35, ear from base of outer margin 0.6, forearm 1.35.

Distribution. The only specimen known, now in the Indian Museum, Calcutta, is from Katmandu, Nepal.

The above description is taken from Dobson's. I have not examined the specimen. Scully has shown that Hodgson's *V. pallidiventr* was the same species.

A bat which will probably be found hereafter in Baluchistan and Southern Afghanistan is *V. desertorum*, Dobson (see *Cat. Chir. B. M.* p. 304), the type of which was obtained at Jalk, within the Persian frontier, and which was subsequently classed by the describer as a subspecies or variety of the European *V. emarginatus*. *V. desertorum* is in any case an extremely well-marked race, larger than the European bat, very pale-colored, both as regards the fur and the membranes, with very thin ears, extending when laid forward to the nostrils, and with the outer margin of the ear-conch deeply and subangularly emarginate about one third below the tip.

The tragus is long, attenuate, and pointed. Wings from the base of the toes. Forearm 1·75 inches.

208. *Vespertilio murinus*. { *The common European Bat*.

Vespertilio murinus, *L. Syst. Nat.* ed. xii, i, p. 47, partim (1766); *Schreb. Säugeth.* i, p. 165, pl. li; *Dobson, Mon. As. Chir.* p. 187; *id. Cat. Chir. B. M.* p. 309; *Anderson, Cat.* p. 141.

Vespertilio blythii, *Tomes, P. Z. S.* 1857, p. 53; *Jerdon, Mam.* p. 45; *Hutton, P. Z. S.* 1872, p. 709.

Myotis mufinus, *Blyth, J. A. S. B.* xxi, p. 300; *id. Cat.* p. 35; *Jerdon, Mam.* p. 46.

Vespertilio africanus, *Dobson, A. M. N. H.* (4) xvi, p. 260 (1875); *id. Cat. Chir. B. M.* p. 310.

Crown of the head slightly raised. Muzzle blunt, area between eye and nostril somewhat tumid, the sides of the face and end of the nose above half naked, but there are some long hairs on the upper



Fig. 108.—Ear of *V. murinus*. (*Dobson, Mon. As. Chir.*)

lip. Ears large, extending to just beyond the end of the muzzle when laid forward, or, in Himalayan specimens, just extending to the nostrils, the tips bluntly pointed; inner margin of the ear-conch moderately convex to the base, where the basal lobe joins at a right angle; outer margin concave below the tip, the upper half wavy, the middle convex; there is a shallow notch opposite the base of the tragus, followed by a convex lobe terminating opposite the base of the inner margin. Tragus of moderate length, narrow, attenuate above and subacutely pointed; inner margin nearly or quite straight; outer with a small basal lobe, then convex for about half its length, becoming straight above.

Wings from the metatarsi. Only the extreme tip of the tail projects from the interfemoral membrane. Basal portion of interfemoral well clad with hair above.

The first upper premolar is about half the height of the third; the second is quite small, but not minute, it is usually somewhat inside the tooth-line, in the angle between the first and third.

Colour of fur greyish to reddish brown, not dark, above, very pale brown to sullied white below, the base of the hairs dark throughout.

Dimensions. Head and body of a male from Kashmir (preserved in alcohol) 2·6 inches, tail 2·2, ear from crown 0·65, forearm 2·25. In fresh specimens, according to Hutton, the head and body measured 3 inches, tail 2½.

Distribution. The Palearctic region generally, as far north as Southern England, Denmark, &c. This species has been found in Kashmir by Sir O. B. St. John, and at Mussoorie, in the Himalayas, by Hutton. The type of *V. blythii* was said to be from Nusseerabad, in Rajputana, but this locality I think requires confirmation.

The Kashmir variety has somewhat shorter ears, and in some cases a more pointed tragus than the normal form.

Habits. *V. murinus* appears late in the evening, and flies low and slowly. It hides during the day in caves and buildings, and hibernates in similar places in considerable numbers together. According to Hutton, it attacks and kills smaller bats when they are kept with it in confinement, and devours some of the flesh. The female has one young, which is generally found clinging to the mother from the end of May till well into July.

200. *Vespertilio dobsoni*. *The Chamba Bat*.

Vespertilio murinoides, Dobson, *J. A. S. B.* xlii, pt. 2, p. 205 (1873); *id.* *Mon. As. Chir.* p. 138; *id.* *Cat. Chir. B. M.* p. 310, nec Lartet, 1851.

Vespertilio dobsoni, Trouessart, *Cat. Mam.* p. 88 (1879).

"Ears slightly shorter than the head; general form of the ear-conch triangular, with narrow rounded tip; the infer margin very faintly convex, almost straight in its upper third; the outer margin concave beneath the tip; the remaining portion convex, with a faint concavity opposite the base of the tragus. The tragus is slender and acutely pointed, with a quadrangular lobe at the base of the outer margin."

"The first upper premolar is very small, scarcely visible from without, and not much larger than the second."

Colour of fur dark brown above, with light brown tips; beneath dark brown, almost black, with greyish tips.

Dimensions of an adult female:—Head and body 2.5 inches, tail 2.1, ear from base of outer margin 0.85, forearm 2.1.

Distribution. Only a single specimen is known. This was procured at Chamba (N.W. Himalaya), at an elevation of 3000 feet.

The type of this species may possibly be an aberrant individual of *V. murinus*, but the differences appear too great. The description is copied from Dobson's, as I have not examined the specimen. The name *V. murinoides* required to be changed, as it was given by Lartet in 1851 to a species found fossil in the Miocene of Sansan, France.

210. *Vespertilio formosus*. *Hodgson's Bat*.

Vespertilio formosus, Hodgson, *J. A. S. B.* iv, p. 700 (1835); Blyth, *J. A. S. B.* xx, p. 158; Dobson, *Mon. As. Chir.* p. 140; *id.* *Cat. Chir. B. M.* p. 311; Anderson, *Cat.* p. 142; Scully, *J. A. S. B.* lvi, pt. 2, p. 254.

Kerivoula pallida, Blyth, *Cat.* p. 34 (1863).

Murina formosa and *Kerivoula pallida*, Jerdon, *Mam.* pp. 42, 43.

Vespertilio auratus, Dobson, *J. A. S. B.* xl, pt. 2, p. 186, pl. x, figs. 1, 2 (1871).

Kerivoula formosa, Hutton, *P. Z. S.* 1872, p. 711.

Vespertilio dobsoni, Anderson, *Cat.* p. 143 (1881), nec Trouessart, 1879.

Face flat, hairy throughout except at the extreme end of the nose; muzzle conical, the nostrils projecting slightly beyond the upper lip, and opening sublaterally, with a shallow hollow between them. Ears scarcely extending to the nostrils when laid forward; tips rounded, directed outwards; outer margin of ear-conch concave, with a wavy outline in the upper half, then convex, and terminating opposite the base of the tragus in a small lobe folded inwards. Tragus long, narrow, obtusely pointed, inner margin straight, outer with a very small lobule at the base, then convex, becoming straight above.

Wing-membrane very broad, attached to the base of the outer toe. Fur thick and woolly. Nearly half the interfemoral membrane is thickly clad with hair above, backs of toes the same. Dentition as in *V. murinus*, the second upper premolar minute.

Colour of fur above fawn-colour to golden brown, below paler and whitish. Some specimens are tinted with rusty red. The dorsal hairs have sometimes the basal third dark brown. The membranes (including the ears) are orange with the exception of black triangular areas between the third and fourth, and fourth and fifth fingers, and inside the fifth, the fingers themselves and the membrane close to them being orange, as in *Cerivoula picta*. The black triangular areas are sometimes dotted and streaked with orange.

Dimensions. Head and body 2·4 inches, tail 1·9, ear from crown 0·55, forearm 1·9.

Distribution. Himalayas near Mussoorie up to 5500 feet, Nepal, Sikhim, Assam, Khasi hills, Bengal (Calcutta, Purneah, Chybassa), and China.

V. dobsoni of Anderson appears to me to be founded on a very large individual of *V. formosus* with the forearm 2·15 inches long.

211. *Vespertilio mystacinus*. *The whiskered Bat*!

Vespertilio mystacinus, *Leisler, Kuhl, Deutsche Flederm.* p. 58 (1817);

Dobson, Mon. As. Chir. p. 133; *id. Cat. Chir. B. M.* p. 314;

Scully, J. A. S. B. lvi, pt. 2, p. 254.

Vespertilio siligorensis (and *V. darjelingensis*?), *Hodgson, Horaf.*

A. M. N. H. (2) xvi, p. 102 (1855); *Jerdon, Mam.* pp. 44, 45.

Crown slightly raised above the face, which is covered with long hairs throughout down to the edge of the upper lip; muzzle narrow. Ears, when laid forward, extending beyond the end of the nose, tips rounded; upper half of outer margin of ear-conch deeply concave with a wavy outline, lower half abruptly convex, with a distinct small lobe at the base. Tragus attenuate above and subacutely pointed; inner margin straight; outer with a small lobule at the base, then sloping outwards to the broadest part of the tragus, opposite about a quarter the height of the inner margin, thence, after a brief convexity, sloping upwards and inwards to the end.

Wings from the base of the toes. A slight projection from

the interfemoral membrane at the end of the calcaneum. The last caudal vertebra free.

Upper incisors subequal, diverging, all bifid. The first upper premolar is twice the height of the second, and scarcely one third the height of the third; the first two slightly internal.

Colour of fur brown, more or less rufescent above, greyish below, basal portion of hairs dark brown or black throughout.

Dimensions. Head and body 1.8 inches, tail 1.55, ear from crown 0.5, forearm 1.35. These are from a Nepal specimen, European individuals as a rule are smaller.

Distribution. Throughout the greater portion of the Palearctic region, extending to the Himalayas, where, however, this species has hitherto been found in Nepal and Sikhim only. Scully states that it is one of the commonest species in the Nepal valley.

Habits. The whiskered bat is generally found in hollow trees, wooden roofs, &c. It flies swiftly, often over water, and appears early in the evening.

212. *Vespertilio muricola*. *The mustachioed Bat.*

Vespertilio adversus, Temminck, *Mon. Mam.* ii, p. 221; Blyth, *J. A. S. B.* xxi, p. 346; *id.* *Cat.* p. 35; Jerdon, *Mam.* p. 45; Hutton, *P. Z. S.* 1872, p. 710; *nee Horsfield*.

Vespertilio muricola, Hodgson, *J. A. S. B.* x, p. 908 (no description); Gray, *Cat. Mam. &c. Nepal and Thibet*, 1846, p. 4; Dobson, *Mon. As. Chir.* p. 134; *id.* *Cat. Chir. B. M.* p. 316; Anderson, *Cat.* p. 142; Scully, *J. A. S. B.* lvi, pt. 2, p. 255.

Vespertilio caliginosus, Tomes, *P. Z. S.* 1859, p. 73; Jerdon, *Mam.* p. 44.

Vespertilio (*Pternopterus*) *lobipes*, Peters, *MB. Akad. Berl.* 1867, p. 706.

Vespertilio blanfordi, Dobson, *P. A. S. B.* 1871, p. 214.

Vespertilio moupinensis, A. Milne-Edwards, *Rech. Mam.* p. 253, pls. xxxvii A, xxxvii C.

Muzzle narrow; face covered with long hair, on the glandular area between each eye and nostril and on the upper lip the covering is thin, though the hairs are very long; only the tip of the nose is naked. The ears laid forward reach the



nostrils, the tips are narrowly rounded, the inner margin of the ear-conch is straight for a third of its length below the tip, then convex, straight again towards the base, the angle of the basal lobe somewhat rounded; outer margin deeply concave with a wavy outline below the tip and for about a third of its length, then convex, slightly emarginate opposite the base of the tragus and ending in a short, distinct, convex lobe. Tragus pointed, the inner margin slightly concave, outer with a well-defined lobe at the base, then strongly convex to above the broadest part of the tragus, and thence sloping in a moderately convex curve to the end.

Fig. 109.—Ear of *V. muricola*. (Dobson, *Cat. Chir. B. M.*)

Wings from the base of the outer toe; tail not projecting beyond the interfemoral membrane. A small convex postcalcanæal lobe.

Second upper premolar slightly within the tooth-row, minute, scarcely visible without a lens.

Colour of the fur above black with pale tips; below, basal portion of the hairs black with ashy tips; membranes intensely black.

Dimensions. Head and body 1·75 inches, tail 1·5, ear from crown 0·42, forearm 1·3.

Distribution. The greater portion of the Oriental region. In the Himalayas this species has been found at Murree, Dalhousie, Simla, and Mussoorie, in Nepal, and in Sikhim, at elevations up to fully 8000 feet; also at Calcutta, in Chutia Nágpur, in Ceylon, Arakan, Tenasserim, and the Mergui Archipelago, and, outside Indian limits, in Eastern Tibet, the Malay Peninsula, Java, Sumatra, Borneo, and Celebes.

No description of this bat was given by Hodgson, and Gray's was imperfect, though it may be accepted, as a type exists in the British Museum.

Habits. According to Hutton, "this bat is early on the wing, coming out of caves and hollow trees, flying high, and is very rapid in its movements. Like *Vesperugo micropus* (*V. abramus*), when touched it opens the mouth wide, without emitting a sound, or making the least attempt to escape or bite."

Genus **CERIVOULA**, Gray (1842).

Syn. *Kerivoula*, Gray.

Muzzle narrow; skull concave between the nose and crown. Glandular region between the eye and nose small, not prominent; mouth wide, the upper lip and angle of the mouth thickly fringed with long hairs. Nostrils circular, opening sublaterally close to the margin of the upper lip. Ears with the outer margin coming forward, so as in great part to conceal the tragus when viewed from the side, and terminating abruptly in a deep lobe, not separated by a notch or concavity, from the upper portion of the ear-margin, nor carried forward to near the angle of the mouth; ear-conch thin, diaphanous, studded with glandular papillæ, from which hairs arise. Tragus extremely long, narrow, and acutely pointed. Membranes of wings and interfemoral area largely developed; calcaneum long and strong, curved backwards; no postcalcanæal lobe; tail equalling or exceeding the head and body in length.

Dentition: i. $\frac{2-3}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$, as in *Vespertilio*, but the upper incisors are parallel, not divergent, and the second upper premolar, though smaller than the third, is never minute.

This genus is essentially tropical, and inhabits the Oriental, Ethiopian, and Australian regions. Three species are recorded from British India and its dependencies.

Synopsis of Indian, Ceylonese, and Burmese species.

- A. Wing-membranes particoloured orange and black *C. picta*, p. 339.
 B. Wing-membranes of the same colour throughout
 a. The ear, when laid forward, does not extend to the nostril; forearm 1·4 *C. hardwickii*, p. 340.
 b. The ear extends to the nostril; forearm 1·7. *C. papillosa*, p. 341.

213. *Cerivoula picta*. *The painted Bat.*

Vespertilio pictus, Pallas, *Spic. Zool.* fasc. iii, p. 7 (1767).

Kerivoula picta, Cantor, *J. A. S. B.* xv, p. 185; *Blyth*, *J. A. S. B.* xx, p. 158; *id.* *Cat.* p. 34; *Kelaart*, *Prod.* p. 25; *Jerdon*, *Mam.* p. 43; *Dobson*, *Mon. As. Chir.* p. 146; *id.* *Cat. Chir. B. M.* p. 332; *Anderson*, *Cat.* p. 144.

Kehel vulha, Cingalese.

Ears moderately long, reaching when laid forward to halfway between the eye and the muzzle, bluntly but distinctly pointed, broad; inner margin very convex and coming forward above the eye, terminating in a rounded basal lobe; outer margin concave just below the tip, then coming forward with a bold convex sweep and terminating abruptly midway between the base of the tragus and the angle of the mouth. Tragus very long, the outer margin without a basal lobe, but with a projecting point opposite the base of the inner margin, from this point the outer margin slopes straight upwards to the fine pointed tip; inner margin straight throughout.

Thumb short; wings from the base of the toes. Face naked in front of the eyes, and around them and the nostrils, but densely haired on the upper lip and above the middle of the nose. Hair is thinly scattered over the wing-membranes near the body, and on the upper surface of the interfemoral; the toes are densely clad, and a thick short fringe of hair extends along the posterior margin of the calcaneum and interfemoral membrane.

Inner upper incisors long and pointed, each with a basal cusp posteriorly and externally situated; outer incisors about equal in length to the basal cusps of the inner. First and second upper premolars subequal.

Colour of fur above deep orange or bright ferruginous, below yellower and paler, the hairs the same tint throughout; ears, antibrachial and interfemoral membranes deep orange; wing-membranes black with orange spots, except along both sides of each finger, the margin of the forearm, and along the body, where the colour is orange.

Dimensions. Head and body 1·5 inches, tail 1·7, forearm 1·4, ear from crown outside 0·4.

Distribution. Widely distributed in India, Ceylon, and Burma, being recorded from Sikhim, Calcutta, Dacca, Jeypore, Bombay,

Madras and the Malabar coast, Ceylon, where it appears to be common, and Burma. Rare in the drier parts of India.

Habits. This very richly-coloured bat is said to be often found on plantain trees (*Musa*), and its Cingalese name, of which the generic term applied by Gray is probably a corruption, means plantain bat. When disturbed in the daytime, *C. picta* looks, as Jerdon remarks, more like a large butterfly than a bat. The brilliant coloration is shown by Swinhoe to be very similar to that of some dead leaves, and consequently to be protective.

214. *Cerivoula hardwickii.* *Hardwicke's Bat.*

Vespertilio hardwickii, Horsfield, *Res. Java* (1824).

Kerivoula hardwickii, Dobson, *Mon. As. Chir.* p. 148; *id. Cat. Chir.*

B. M. p. 335; *Anderson, Cat.* p. 145.

Kerivoula fusca, Dobson, *P. A. S. B.* 1871, p. 215.

Ears a little longer than in *C. picta*, but not extending to the nostrils when laid forward; tips thoroughly rounded, inner margins regularly convex from end to end; outer margins deeply concave below the tip, then much expanded, even more so than in *C. picta*. Tragus very long and much attenuated, inner margin straight, outer with a small angular projection opposite the base of the inner margin, above this convex, the upper two thirds concave, tip pointed.



Fig. 110.—Head of *Cerivoula hardwickii*. (Dobson, *Mon. As. Chir.*)

Thumb large. Wings from the base of the toes. Posterior margin of interfemoral membrane finely crenulated and fringed with very few hairs. All the membranes nearly naked, the fur being almost confined to the body.

Upper inner incisors without any posterior cusp, outer incisors scarcely half the length of the inner. First upper premolar equal to the third in height, though less in section, second premolar about one third shorter.

Colour of fur greyish brown above and below, the basal half dark brown. Membranes uniformly dark.

Dimensions. Head and body 1·5 inches, tail 1·7, ear from crown outside 0·45, forearm 1·4.

Distribution. Probably throughout the greater part of the Oriental region. A specimen, now in the British Museum, was obtained by Mr. Theobald in the Punjab on the Indus, another is from Ceylon, and others are recorded from Assam and the Khási hills, as well as from Cambodia, Java, Borneo, &c.

215. *Cerivoula papillosa*. The papillose Bat.

Vespertilio papillosus, Temminck, *Mon. Mam.* ii, p. 220 (1835-41).
Kerivoula papillosa, *Tomes, P. Z. S.* 1858, p. 327; *Jerdon, Mam.*
 p. 43; *Dobson, M. Z. As. Chir.* p. 160; *id. Cat. Chir. B. M.*
 p. 337.

Ears very similar to those of *C. hardwickii* but longer, extending to the end of the muzzle, and the outer margins do not project so much in front. A dense fringe of hair on the upper lip. Wings from the base of the claws; thumbs and feet large and armed with large and strong claws. Dentition as in *C. hardwickii*, but upper incisors shorter.

Colour of fur on back glossy brown, head and lower parts paler and greyer, basal two thirds of the hair dark brown throughout.

Dimensions. Head and body 2·2 inches, tail 2·2, forearm 1·7.

Distribution. A specimen was sent from Calcutta by Mr. Pearson, and is now in the British Museum. *Tomes* also records one from Ceylon, but the identification is less certain; nor is it absolutely proved that the first specimen was Indian, though this is probable. The only other known localities are Java and Sumatra.

This species is easily distinguished from *C. hardwickii* by its much larger size and by its colour.

There is another species, *C. brunnea*, *Dobson, Cat. Chir. B. M.* p. 334, closely resembling *C. picta* in size and structure, but with the membranes dark brown, the fur yellowish brown above, greyish brown below, all the basal portion of the hair dark brown, and the upper incisors nearly equal in size. The type of this was presented by Sir A. Smith to the British Museum, and it is quite uncertain whether the specimen came from Madras or South Africa.

Genus **MINIOPTERUS**, Bonaparte (1837).

Crown of the head much raised above the face-line. Ears separate, short, rounded, the outer margin terminating just behind the angle of the mouth; tragus as in *Vesperugo*, of moderate

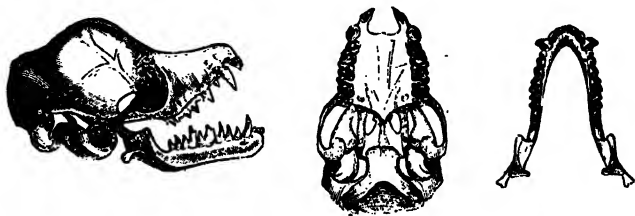


Fig. 111.—Skull of *Miniopterus schreibersi*, $\times 2$. (Blasius, Säugeth. Deutschlands.)

length, blunt, not attenuated above. Nostrils not tubular, crescentic. Muzzle broad; the median portion of the upper lip

below the nose forming a kind of depression sharply divided on each side from the more swollen lateral portions of the lip. The first phalanx (middle joint) of the third or longest finger very short, less than one third the length of the second or terminal phalanx, which is very long, and is folded in repose on the under surface of the wing, reaching beyond the middle of the metacarpal bone. The wings are attached to the inferior surface of the tibia just above the ankle, and connected with the interfemoral membrane by a band of integument passing below the tibia. Tail as long as the head and body, entirely contained within the interfemoral membrane.

Dentition: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{3-3}$, m. $\frac{3-3}{3-3}$.

But a single representative is found in India. This has the same range as the genus and almost the widest range of any species in the Order, being found in Southern Europe, Asia, Africa, Madagascar, and Australia.

216. *Miniopterus schreibersi*. *The long-winged Bat.*

Vespertilio schreibersi, Natterer, Kuhl, *Deutsche Flederm.* p. 41 (1817).

Vespertilio fuliginosa, Hodgson, *J. A. S. B.* iv, p. 700 (1835).

Scotophilus fuliginosus, Jerdon, *Mam.* p. 36 (description incorrect).

Miniopterus australis, Dobson, *J. A. S. B.* xl, pt. 2, p. 265, *nee Tomes*.

Miniopterus blepotis, Temm., Hutton, *P. Z. S.* 1872, p. 709.

Miniopterus schreibersi, Dobson, *Mon. As. Chir.* p. 160; *id. Cat. Chir. B. M.* p. 348; Anderson, *Cat.* p. 145; Scully, *J. A. S. B.* lvi, pt. 2, p. 256.

Miniopterus pusillus, Dobson, *Mon. As. Chir.* p. 162.

Muzzle short; glandular area between the eye and nostril extending to the upper lip, prominent, thinly clad, but bearing rather long hairs; forehead thickly clothed with long hair. Ears of a subtrigonally rounded form, only extending, when laid forwards, to just beyond the eyes; tips indistinct, blunt; inner margin of the ear-conch very convex, outer margin deeply notched



Fig. 112.—Head of *Miniopterus schreibersi*. (Blasius, *Säugeth. Deutschlands*.)

opposite the base of the tragus and ending in a long convex lobe that extends from the base of the tragus to the angle of the mouth. Tragus rounded above, and with the margins nearly

parallel, the inner concave, the outer convex and without any distinct lobule at the base.

Wings to the ankles or rather higher. Fur soft, dense, and long.

Colour in Indian specimens generally dark brown, varying from reddish to blackish brown above; the hairs of the same colour throughout; below rather paler and greyer, with the basal portion of the fur dark. European and North-African specimens are grey, with the membranes pale and whitish, and similar individuals may be expected to occur in Baluchistan.

Dimensions. Head and body 2·3 inches, tail 2·3, ear from crown of head 0·25, forearm 1·9. In Burmese specimens the forearm is as much as 2 inches, in Ceylon no more than 1·75, and in the variety *pusillus* only 1·6.

Distribution. Throughout Southern Europe, Southern (and great part of Central) Asia, Africa, Madagascar, and Australia. This species does not appear to be common in India: it has been recorded from Mussoorie in the Himalayas, at 2000 to 7000 feet, also from Nepal, Ceylon, and Upper Burma, and the smaller variety *pusillus* from Madras and the Andaman and Nicobar Islands.

Varieties. The small variety just mentioned was at first referred by Dobson to *M. australis*, a small species with the interfemoral membrane half covered with hair above, but subsequently regarded as a variety or subspecies of *M. schreibersi*, a view in which I agree, as the differences do not appear to me specific. There is a little more hair on the interfemoral membrane, but Himalayan specimens show an intermediate phase.

Habits. The long-winged bat is one of the swiftest fliers in the Order, according to Blasius it almost resembles a swallow in its powerful flight and graceful movements on the wing. It appears early in the evening. During the day it hides in caves, crevices in rocks, and similar retreats, such as old buildings, tombs, &c. Hutton states that he never met with a specimen that was not infested with ticks.

Family EMBALLONURIDÆ.

No nose-leaf. Ears often united; a tragus present, though it is sometimes very small; it is frequently expanded above. Two phalanges in the middle finger, besides the metacarpal bone, the first phalange folded in repose on the upper surface of the metacarpal*. Tail partially free, either perforating the interfemoral

* There are some exceptions, but not in India. In *Rhinopoma* the folding is less complete than in other Indian genera.

membrane and appearing upon its upper surface, or else produced far beyond its posterior margin.

The number of teeth varies. The muzzle is usually obliquely truncated, and projects more or less beyond the lower lip.

This family, which is generally distributed throughout the tropical and subtropical regions of the world, is represented in India, Ceylon, and Burma by the following four genera, classed in two subfamilies :—

- | | |
|---|------------------------|
| I. Tail emerging from the upper surface of the interfemoral membrane, legs long, fibulae very slender; upper incisors weak..... | <i>Emballonurinae.</i> |
| A. Tail shorter than interfemoral membrane; index finger formed by metacarpal alone. | |
| a. Incisors $\frac{2-2}{6}$, upper incisors persistent .. | EMBALLONURA. |
| b. Incisors $\frac{1-1}{4}$, upper incisors deciduous .. | TAPHOZOUS. |
| B. Tail very slender, much longer than short interfemoral membrane; index finger with a metacarpal bone and two phalanges | RHINOPOMA. |
| II. Tail thicker than the thigh and produced far beyond the interfemoral membrane, which it leaves at posterior margin; legs short and stout; upper incisors strong.... | <i>Molossinae.</i> |
| A. Upper lip much wrinkled vertically | NYCTINOMUS. |

Subfamily EMBALLONURINÆ.

Genus **EMBALLONURA**, Temm. (1838).

Ears arising separately from the sides of the forehead; the outer margin of the ear-conch terminating below the eye and behind the angle of the mouth; tragus longer than broad. Forehead flat, not concave. Apertures of the nostrils circular or elliptical, close together at the extremity of the conical muzzle. Tail perforating the large interfemoral membrane about its centre and the tip appearing free on the upper surface; the posterior free margin of the membrane supported by long calcanea.

Dentition : i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Upper incisors in pairs, separated from the canines and from each other.

This genus is entirely oceanic, ranging from Madagascar to the islands of Polynesia; no species has yet been found on the continent of Asia or in Australia, but one has been met with in the Mergui Archipelago.

217. *Emballonura semicaudata*. *The Polynesian sheath-tailed Bat*.

Vespertilio semicaudatus, Peale, *U. S. Expl. Exp.*, *Quad.* p. 23 (1848).
Emballonura semicaudata, Dobson, *Cat. Chir. B. M.* p. 360.

The extremity of the narrow muzzle projects beyond the upper lip; nostrils circular, with a shallow concavity between; lower lip crossed in the middle by a furrow, which expands above. Sides of the face and the whole muzzle in front of the eyes half-naked; some long hairs on the upper lip; forehead thickly covered with



Fig. 113.—Head of *Emballonura semicaudata*.

long hair. The ears do not extend to the nostrils when laid forward, the tips are narrowly rounded off; outer margin of the ear-conch concave below the tip, slightly emarginate below the base of the tragus, and terminating in a short convex lobe; inner margin straight above, slightly convex below. Tragus almost squarely truncated above, both margins nearly straight and subparallel, the inner slightly concave, the outer convex near the end, and having a small indistinct lobe folded on itself opposite the base of the inner margin.

Wings from the ankles. Tail very slender, only the tip projects above the middle of the large interfemoral membrane. Fur long and short, but not dense.

Colour of fur reddish to blackish brown, rather paler below; the hairs a little paler towards the base.

Dimensions of a male from the Mergui Archipelago in spirit:—Head and body 1.65, tail 0.5, ear from crown of head 0.42, forearm 1.75.

Distribution. This species until lately had only been found in the islands of the Pacific, especially in the Fiji Islands. Recently a specimen was received at the British Museum from Sarawak in Borneo, and Dr. Anderson has found the same bat in the Mergui Archipelago.

Genus **TAPHOZOUS**, Geoffroy (1813).

Muzzle conical, broad behind, narrow in front, terminated by the slightly projecting inner margins of the nostrils, which are valvular and circular or elongate. Crown of head slightly raised, in

front of it there is a deep frontal hollow between the eyes. Ears separate and of moderate length; varying but little in shape in the different species; the tips are bluntly pointed or rounded; the inner margin of the ear-conch rises as a low band from between the eye and the frontal hollow, and is straight or slightly convex, and the outer margin is faintly notched opposite the base of the tragus and ends in a convex lobe, terminating behind the angle of the mouth, and halfway between it and the base of the tragus. The tragus is short and shaped like half a dumbbell, the upper termination expanded and convex, the sides concave. The lower lip is as long as the upper and terminated by a triangular naked area more or less deeply furrowed in the middle.

The tail perforates the interfemoral membrane about the middle, and the last three or four vertebrae are usually found extending free beyond, but they are capable of being partially withdrawn as if into a sheath.

Dentition: i. $\frac{1-1}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. The premaxillaries are cartilaginous, and the upper incisors are minute and are generally wanting in adult animals. The upper canines are closer together than in most bats and separated from the second premolar on each side by a space, in the middle of which the small first premolar is seen, only just appearing above the gum. Second upper premolar higher than the molars. Last upper molar very small. Lower incisors tricuspid, overlapping slightly.

Several of the species have a glandular gular sac, in some cases confined to the male, in others occurring in both sexes, between the rami of the lower jaw, occupying about half the space. In many of the species also a small band of membrane passes from the inferior surface of the forearm near its distal extremity to the proximal extremity of the fifth metacarpal bone, so as to form with the wing-membrane a small pouch termed by Dobson the *radio-metacarpal pouch*.

The genus ranges throughout the greater portion of the Ethiopian, Oriental, and Australian regions, and the southernmost part of the Palearctic. Five species occur within Indian limits.

Synopsis of Indian, Ceylonese, and Burmese Species.

- a. A radio-metacarpal pouch present; lower lip scarcely grooved.
 - a'. No gular sac in either sex.
 - a''. Fur of back extending on to base of interfemoral membrane; forearm 2·5. *T. melanopogon*, p. 347.
 - b''. Interfemoral membrane quite naked.
 - a'''. The abdomen hairy throughout; forearm 3. *T. theobaldi*, p. 348.
 - b'''. The lower abdomen naked; forearm 2·05. *T. kachhensis*, p. 349.
 - b'. A gular sac present in males, rudimentary but represented by a naked area in

- females; interfemoral hairy to the exsertion of the tail; forearm 2·4 *T. longimanus*, p. 348.
b. No radio-metacarpal pouch; lower lip with a deep median transverse groove; gular sac in both sexes; forearm 2·0 *T. saccolæmus*, p. 350.

218. *Taphozous melanopogon*. .The black-bearded sheath-tailed Bat.

Taphozous melanopogon, Temminck, *Mon. Mam.* ii, p. 287, p. 60, figs. 8, 9 (1835-41); Cantor, *J. A. S. B.* xv, p. 180; Jerdon, *Mam.* p. 31; Dobson, *P. Z. S.* 1875, p. 548; *id.* *Mon. As. Chir.* p. 167; *id.* *Cat. Chir. B. M.* p. 380; Anderson, *Cat.* p. 146.

No gular pouch; throat always hairy. Radio-metacarpal pouch extending about one-fourth the length of the fifth metacarpal bone. A row of small papillæ on the inner margin of the ear. Thick hair covers the forehead to between the eyes, remainder of the face and the sides of the head very thinly clad with short hairs.

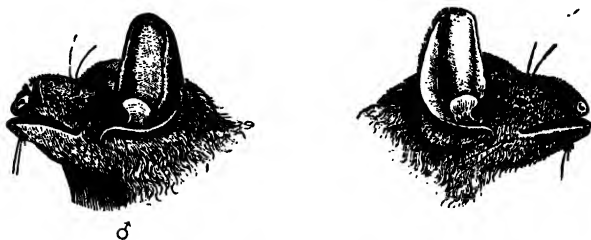


Fig. 114.—Head of *Taphozous melanopogon*, male and female. (Dobson, *P. Z. S.* 1875.)

Wings from the tibiæ above the ankles. The fur extends about one-third down the upper surface of the humerus and femur and very slightly upon the membrane between them. The interfemoral is thinly covered almost as far as the point where the tail perforates it.

Colour of the fur smoky brown to greyish brown, the basal portion white. There is not much difference between the upper and lower surfaces. Some specimens are blackish brown. In males there is sometimes a large patch of long black hairs on the throat (fig. 114), but this character, from which the species has been named, is not always present and may, as Dobson suggests, be assumed at the breeding-season.

Dimensions. Head and body 3·1 inches, tail 1, ear from crown 0·55, forearm 2·5.

Distribution. Probably throughout the greater part of the Oriental region. Recorded from Lower Bengal, Chutia Nagpur, Sambalpur, Canara (Malabar Coast), Trichinopoly, Upper Burma, and Tenasserim; also from Cochin China, Java, Borneo, and the Philippine Islands.

219. *Taphozous theobaldi*. *Theobald's sheath-tailed Bat*.

Taphozous theobaldi, Dobson, P. A. S. B. 1872, p. 152; *id.* P. Z. S. 1875, p. 550; *id.* Mon. A. Chir. p. 168; *id.* Cat. Chir. B. M. p. 381; Anderson, Cat. p. 147.

No gular pouch. Ears larger than in any other species, the inner margins papillate. Radio-metacarpal pouch larger even than in *T. melanopogon*. No black beard has been observed.

The wing and interfemoral membranes are quite naked above; the limit of the body-fur in the lumbar region is defined by a well-marked line convex inwards (in *T. melanopogon* and *T. nudiventris* the convexity is outwards). In other respects, except size, this species does not appear to differ from *T. melanopogon*.

Dimensions. Head and body 3.35 inches, tail 1.35, ear from base of outer margin 1.1, forearm 3.

Distribution. Tenasserim. One specimen from Bushire, Persian Gulf, is identified with the species in Anderson's Catalogue.

I have been unable to examine a specimen, and the above description is taken from Dobson's.

220. *Taphozous longimanus*. *The long-armed sheath-tailed Bat*.

Taphozous longimanus, Hardwicke, Tr. I. S. xiv, p. 525 (1823); Blyth, J. A. S. B. x, p. 974, xiii, p. 490, xx, p. 156, xxi, p. 348, xxii, p. 414, xxiv, p. 711; *id.* Cat. p. 20; Jerdon, Mam. p. 31; Dobson, P. Z. S. 1875, p. 551; *id.* Mon. As. Chir. p. 170; *id.* Cat. Chir. B. M. p. 384; Anderson, Cat. p. 147.

Taphozous fulvidus and *T. brevicaudus*, Blyth, J. A. S. B. x, pp. 975, 976.

Taphozous cantori, Blyth, J. A. S. B. xi, p. 784.

Taphozous longimanus and *T. brevicaudus*, Kelaart, Prod, p. 12.

A well-developed gular sac in males, in females it is represented by a fold of the skin and the absence of hair in the area between the fold and the chin. Radio-metacarpal pouch moderately large. Inner margin of ear smooth, not papillate.

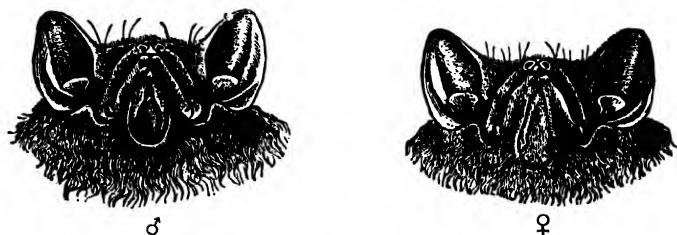


Fig. 115.—Head of *Taphozous longimanus*, male and female. (Dobson, P. Z. S.)

Wings from the tibiae just above the ankles. On the upper surface of the wing-membrane the hair extends as far as a line joining the middle of the humerus with that of the femur; on the

interfemoral as far as the point of exertion of the tail; a few scattered long hairs on the free part of the tail itself. The hair extends farther on the wing-membrane below than above, whilst the interfemoral is almost naked on its lower surface. Muzzle almost naked.

The upper incisors are generally absent, in young individuals they are small and slender.

Colour of fur reddish brown to black, nearly the same above and below; the hairs paler, often whitish at the base. Blyth observed that young individuals are pale fulvescent and that they grow gradually blacker with age.

Dimensions. Head and body 3 inches, tail 1·1, ear from crown 0·5, forearm 2·4.

Distribution. Throughout the greater part of the Indian Peninsula, Ceylon, and Burma, extending to Tenasserim and Malacca; common about Calcutta (whence originally described), Madras, and other large towns. Not yet recorded from Northern or North-western India, but found in parts of the Southern Central Provinces (Chanda, Bilaspur); also near Bombay and Travancore.

Habits. This species is probably a cave-dweller and inhabitant of rock-fissures; it is frequently found in old temples, cellars, out-houses, &c. It was, however, once observed by Blyth on the stem of a palm-tree. The same observer noticed that individuals in confinement could cling to the vertical smooth mahogany back of a cage, and creep up it by means of their claws. In pregnant females a single young one was found early in August in Calcutta.

221. *Taphozous cachhensis.* *The Cutch sheath-tailed Bat.*

* *Taphozous kachhensis*, Dobson, *P. A. S. B.* 1872, p. 152; *id. J. A. S. B.* xli, pt. 2, p. 221.

Taphozous nudiventris subsp. *kachhensis*, Dobson, *P. Z. S.* 1875, p. 554; *id. Mon. As. Chir.* p. 172; *id. Cat. Chir. B. M.* p. 388; Anderson, *Cat.* p. 148.

No gular sac, but its position is slightly indicated in males, not in females. Radio-metacarpal pouch small. Ear-conch with papillæ on the inner margin.

Wings from the tibiæ above the ankles. The muzzle is nearly naked. The wing and interfemoral membranes are quite naked above, as are the arms and legs, the hair terminates abruptly on the lower part of the back. Beneath, the proximal portion of the humerus and the wing-membrane as far as a line from the middle of the humerus to the pubis are hairy, but the lower abdomen, legs, and interfemoral membrane are quite naked. There are large deposits of fat about the root of the tail.

Colour not recorded, probably greyish brown as in *T. nudiventris*.

Dimensions. Head and body in a female 3·6 inches, tail 1·25, forearm 2·95; in a male 3·35, 1·15, and 2·65. The ear from the base of the outer margin measures 0·9.

Distribution. Sind and Cutch. This species is closely allied to *T. nudiventris* of Africa and South-western Asia, only differing in the want of a gular sac in the male and to some extent in measurement. In his last works Dobson has classed the present form as a variety of *T. nudiventris*, and it is very probable that the two are not specifically distinguishable.

222. *Taphozous saccolaimus.* *The pouch-bearing sheath-tailed Bat.*

Taphozous saccolaimus, *Temm. Mon. Mam.* ii, p. 285, pl. 60, figs. 1-6 (1835-41); *Cantor, J. A. S. B.* xv, p. 180; *Blyth, J. A. S. B.* xxi, p. 348; *id. Cat.* p. 28; *Jerdon, Mam.* p. 32; *Dobson, P. Z. S.* 1875, p. 555; *id. Mon. As. Chir.* p. 172; *id. Cat. Chir. B. M.* p. 388; *Anderson, Cat.* p. 149.

Taphozous crassus, *Blyth, J. A. S. B.* xiii, p. 491.

Taphozous pulcher, *Elliot, ib.* p. 492.

Ears short. Gular sac well developed in both sexes, but much larger in the male. No radio-metacarpal pouch. Inner margin of ear-conch smooth. Lower lip with a deep transverse median groove.

Wings from the ankles. The muzzle, including the eyes and the sides of the head, nearly naked. The tragus is hairy posteriorly, and there is some short hair on the inner surface of the ear-conch. Above, the fur extends on to the proximal half of the humerus, but the wing-membrane, the interfemoral, and the legs are naked; there are a few isolated long hairs on the free portion of the tail. Beneath, the wing-membrane near the body is hairy, the interfemoral naked except at the base of the tail.

Colour of fur various shades of brown—pale, ferruginous, and blackish, in some cases mottled with spots of white, the hairs paler at the base. The lower surface scarcely paler as a rule, though Blyth describes a form from Southern India said to be white beneath, like the Malayan *T. affinis*.

Dimensions. Head and body 3·5, tail 1·3, ear from crown 0·48, forearm 2·9 inches. Some specimens are smaller; in one I find the forearm only 2·5 inches long.

Distribution. Peninsula of India (Mirzapur, Madras), Ceylon, Sylhet, Burma, the Malay Peninsula, Sumatra, and Java. Remains of this species have been found fossil in the Pleistocene cave-deposits of Kurnool in the Madras Presidency.

Habits. This, like other species of the genus, inhabits caves and masonry buildings during the day. Like them, too, it has a very disagreeable smell. It is said to utter a very shrill cry.

Genus **RHINOPOMA**, Geoffroy (1813).

Crown of head convex, not greatly raised; a deep frontal hollow; ears with their inner margins united by a band across the hollow; tragus of moderate size. Muzzle thick, obliquely truncated, projecting considerably beyond the lower lip; nostrils placed some

distance above the lip, in the front surface of the muzzle, they are valvular and open with a narrow transverse slit. Index finger with



Fig. 116.—Skull of *Rhinopoma microphyllum*, $\times 2$. (Dobson, Mon. As. Chir.)

two phalanges besides the metacarpal bone; the third or longest finger with the first phalanx bent upwards in repose, but not resting on the dorsal surface of the metacarpal, being prevented by the great length of the index finger. Tail very long and slender, produced far beyond the posterior border of the short interfemoral membrane.

Dentition: i. $\frac{1-1}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{1-1}{2-2}$, m. $\frac{3-3}{2-3}$. Upper incisors rudimentary. The small premaxillary bones are united in the middle, and connected by curved lateral processes with the maxillary bones. Nasal bones much expanded laterally and vertically; frontal bones depressed, forming a shallow concavity in the forehead.

This genus contains a single species ranging from Egypt and Kordofan to the Malay Peninsula.

223. *Rhinopoma microphyllum*. *The long-tailed Bat*.

Rhinopoma microphyllum, Geoffroy, *Descr. de l'Egypte, Hist. Nat.* ii, p. 123 (1813); Blyth, *J. A. S. B.* xiii, p. 492.

Rhinopoma hardwickii, Gray, *Zool. Misc.* p. 37; Cantor, *J. A. S. B.* xv, p. 178; Elliot, *Mad. Jour. L. S.* x, p. 97; Blyth, *Cat.* p. 28; Jerdon, *Mam.* p. 29; Dobson, *J. A. S. B.* xli, pt. 2, p. 221.

Rhinopoma microphyllum, subsp. *hardwickii*, Dobson, *Mon. As. Chir.* p. 176.

Rhinopoma microphyllum, Dobson, *Cat. Chir. B. M.* p. 400; Anderson, *Cat.* p. 149.

From the frontal hollow crossed by the band connecting the ears a deep furrow leads to the nose and terminates behind the fleshy prominence that forms the upper part of the truncated muzzle. The bluntly pointed tips of the ears laid forwards just extend to the edge of the muzzle; the margins of the ear-conch are convex, the outer terminating behind the angle of the mouth just in front of the base of the tragus. The tragus is much longer than wide, the tip very obtuse, outer margin slightly convex with a lobe at the base, inner margin forming an ogee curve, the concavity above.

Face almost naked; no fur on the wing-membrane or the interfemoral; the lower portions of the back and abdomen and the legs are also naked.

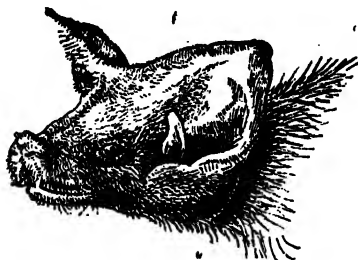


Fig. 117.—Head of *Rhinopoma microphyllum*.

Colour of fur dull greyish brown, nearly the same above and below; the hairs paler at the base.

Dimensions. An adult male measures: head and body 3 inches, tail 2·35, ear from crown 0·6, forearm 2·6. But many specimens are considerably smaller, with a forearm 2·1 or even less.

Distribution. Egypt and Kordofan in Africa; South-eastern Asia, India generally, Burma and the Malay Peninsula. Not recorded from the Himalayas or Ceylon.

Habits. This species is common in North-western India, and hides during the day in caves, clefts in rocks, old ruins, and similar places. In Cutch it takes up its abode in wells. Jerdon relates that in Madras, in 1848, many were captured in a house for three successive nights, having probably been blown by strong westerly winds from the rocky hills to the westward. The species is not of common occurrence in Madras. According to Blyth this species abounded formerly in the Taj at Agra (it may still be found there), and Cantor found numbers inhabiting the subterranean Hindu place of worship within the Fort at Allahabad.

This species may be distinguished from all other bats by the very long slender free tail. In the cold season there is an enormous accumulation of fat, sometimes exceeding the remainder of the body in weight, under the skin below the anus. The fleshy point above the truncated muzzle is sometimes called a nose-leaf, but incorrectly.

Subfamily MOLOSSINÆ.

This subfamily includes the genera of *Emballonuridæ* with short and strong legs and feet and well-developed fibulæ. All have callosities at the base of the thumbs, and the feet free from the wing-membrane, whilst the interfemoral membrane is partially retractile. The species of this subfamily are thus evidently better fitted than any other bats for terrestrial progression, and the habits

of the few species on which observations have been made agree with their structure.

The majority of the species are American : one genus, *Mystacina*, is peculiar to New Zealand ; another, *Chiromeles*, with a single species *C. torquatus*, a large bat almost entirely naked, is found in the Malay Peninsula and islands and may very possibly inhabit Tenasserim ; whilst the only species yet recorded within Indian limits are two forms of *Nyctinomus*.

Genus **NYCTINOMUS**, Geoffroy (1813).

Syn. *Dinops*, Savi ; *Dysopes*, Rüppell *nec* Illiger.

Muzzle thick, obliquely truncated, projecting considerably beyond the lower jaw ; nostrils circular or subcircular, directed outwards, forwards and downwards, with slightly projecting margins. Upper lip very thick and vertically wrinkled. Ears thick, large and broad, more or less united on the forehead in front of the eyes ; a straight thickened basal lobe inside the ear-conch. Tragus small, subquadrate. Basal portion of the tail as thick as the thigh. Legs very short ; feet broad, each outer and inner toe thickened on its exterior side by a lateral pad, furnished with a dense tuft of long curly hair. Middle finger much lengthened, its metacarpal bone equal to the whole length of the fifth finger, its first phalanx folded backwards in repose. A well-marked callosity at the base of the thumb.

Dentition : i. $\frac{2}{6}$ or $\frac{2}{4}$, c. $\frac{1-1}{1-1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. A few species, not Indian, have pm. $\frac{1-1}{2-2}$.

The interfemoral membrane, as in all allied genera, forms a sheath to the base of the tail and can be moved up or down the latter, thus increasing or diminishing the membranous surface.

The genus *Nyctinomus* is found in the warmer parts of both hemispheres, one species occurring in Southern Europe.

Synopsis of Indian and Burmese species.

Ears not quite united at base ; about half the tail

free *N. tragatus*, p. 353.

Ears united at base ; more than half the tail free . . . *N. plicatus*, p. 354.

224. Nyctinomus tragatus. *Dobson's wrinkled-lipped Bat.*

Nyctinomus tragatus, Dobson, *J. A. S. B.* xliii, pt. 2, p. 143 ; *id.* Mon.

As. Chir. p. 181 ; *id.* Cat. *Chir. B. M.* p. 424 ; *Anderson, Cat.* p. 150.

Ears arising close together from the anterior part of the forehead, but not joined by a band ; they extend when laid forward to the extremity of the muzzle or a little beyond it ; upper portion of the ear-conch regularly convex, almost semicircular ; outer margin separated from the terminal lobe or antitragus by a deep notch.

From inside the inner margin a thick prominent basal lobe runs directly across the inside of the conch and covers the eye. Tragus small, subquadrate, convex above.

Thumb short with a small claw. Wings from just above the ankles. Calcaneum elongate, extending nearly three quarters of the distance from ankle to tail. Only about half the tail extends beyond the end of the membrane.

Lower incisors 6, the median pair smaller and shorter than the others. Upper incisors nearer to each other than to the canine on each side. The first upper premolar very small.

The face and ears nearly naked; proximal portions of upper arms and thighs and the wing-membrane close to the body hairy. The interfemoral membrane only hairy near the base of the tail. Some long hairs on the toes.

Colour of fur greyish to blackish brown, nearly the same above and below; basal portion of hairs paler.

Dimensions. Head and body 2·9 inches, tail 1·75, forearm 2, tibia 0·6, ear from crown of head 0·6.

Distribution. Specimens have been obtained from Rajanpur (S.W. Punjab), Nasirabad (Rajputana), Malabar, Jashpur (Chutia Nagpur), and Calcutta; so this form, although not common, has evidently a wide range in the Peninsula of India.

225. *Nyctinomus plicatus.* *The Indian wrinkled-lipped Bat.*

Vespertilio plicatus, Buchanan, *Tr. L. S.v.* p. 261, pl. 13 (1800); Geoffr.

Descr. de l'Egypte, Hist. Nat. ii, p. 130 (1813).

Nyctinomus tenuis, Horsfield, *Zool. Res. Java*; Cantor, *J. A. S. B.* xv, p. 179.

Dysopes murinus, Gray & Hardwicke, *Ill. Ind. Zool.* vol. i, pl. i.

Dysopes plicatus, Blyth, *J. A. S. B.* xx, p. 517, xxii, p. 410, xxv, p. 440.

Nyctinomus plicatus, Blyth, *Cat.* p. 29; Jerdon, *Mam.* p. 33; Dobson, *Mon. As. Chir.* p. 182; *id.* *Cat. Chir. B. M.* p. 425; Anderson, *Cat.* p. 151.



Fig. 118.—Head of *Nyctinomus plicatus*.

Ears distinctly joined by a band connecting their inner margins on the muzzle about halfway between the eyes and the end of the nose. They are large, though barely extending to the nostrils when laid forward, subtrapezoidal, upper margin not regularly convex; outer margin separated from the antitragus or terminal

lobe by a deep notch. The thickened horizontal basal lobe commences some distance inside the inner margin, and extends nearly across the ear-conch inside, covering the eye. Tragus very small, subtriangular, truncated above. Muzzle broad, lips very thick, the upper overhanging the lower, both wrinkled, but the upper more so.

Wings from tibia, the point of junction varying. Calcaneum short, scarcely extending half the distance from the ankle to the tail. The free portion of the tail longer than that contained in the membrane. Distribution of the fur as in *N. tragatus*.

Lower incisors 4, first upper premolar small.

Colour of fur brownish black to greyish brown above, sometimes the same but generally paler below, basal portion of the hair lighter in colour.

Dimensions of an adult male: head and body 2·7 inches, tail 1·55, forearm 1·95, tibia 0·65, ear from crown 0·5.

Distribution. Generally distributed throughout India, Burma, and the Malay countries, but not recorded from Ceylon or the Himalayas.

Habits. This bat is found during the day in caves, deserted masonry buildings, &c. Tickell met with it in countless myriads inhabiting limestone caves at Phagat, 30 miles from Moulmain. It has, like others of the genus, a steady powerful flight high in the air, effected by sweeps of its long narrow wings. An allied species, *N. cestoni*, has the power of sinking its eye in the socket and thrusting it out again.

Two other species of *Nyctinomus*, *N. mops* and *N. johorensis*, are found in the Malay Peninsula and islands, as is also *Chiromeles torquatus*, already mentioned.

Order RODENTIA.

The Orders hitherto noticed follow each other in fairly natural sequence. The Rodents, comprising squirrels, marmots, rats and mice, jerboas, porcupines, hares and their allies, have no connexion with the Chiroptera, and but little with any other order of mammals. Like the Insectivora and Chiroptera, the Rodentia are mostly animals of small size.

Rodents can be readily distinguished by their dentition. There are no canines, and there are always two large, chisel-shaped rootless incisors, with the anterior surface curved, in front of each jaw. There are never more than two incisors in the lower jaw; in the upper there are, in one suborder, additional small incisors behind the anterior pair, not at the side of them as usual. The large incisors, or "rodent tusks" as they are sometimes termed, grow throughout the lifetime of the animals, and have long basal portions extending into deep alveoli. The incisors are widely separated from the grinding-teeth. Premolars may be present or absent. There are almost always three true molars in each side of each jaw; the crowns of these molars are in most cases tubercular, and, when worn, traversed by laminae of enamel.

The most important character of the skull is the large size of the premaxillary bones, which contain the elongate basal portions of the upper incisors, and completely separate the nasals from the maxillaries. The orbits are never circumscribed by bone, and post-orbital processes are generally wanting. A zygomatic arch is always present. The condyle of the mandible is longitudinal, so that the lower jaw works backwards and forwards.

The mouth is divided into an anterior cavity containing the incisors, and a posterior cavity containing the molars, the two connected by a constricted orifice, lined partially or wholly by the hairy integument of the face. The feet are plantigrade, or semi-plantigrade, usually pentadactyle, and unguiculate. The intestine has a large cæcum (except in *Myoxidae*); the uterus is double or two-horned, and the placenta discoidal and deciduate. In many families the females have an elongated perforate clitoris in front of the genital orifice, and may easily be mistaken for males. The testes in most rodents (not in the *Duplicidentata*) are retained in the abdomen, except in the rutting-season, when they become greatly enlarged. The cerebral hemispheres are smooth and do not extend back over any part of the cerebellum.

Rodents are cosmopolitan in distribution, and comprise more species than any other Mammalian order. Nearly all are exclusively

vegetable feeders. They are divided into two suborders, thus distinguished:—

Two incisors in upper jaw *SIMPLICIDENTATA*.

Four incisors in upper jaw (two of them small
and placed behind the others) *DUPLICIDENTATA*.

Suborder *SIMPLICIDENTATA*.

Only two incisors in the upper jaw; enamel confined to the anterior surface. Anterior palatine foramina small or moderate, and distinct from each other. Bony palate well developed. The fibula does not articulate with the *os calcis*. Testes generally contained within the abdomen, and only descending in the rutting-season, when they form a great protuberance in the inguinal region.

To this suborder belong by far the greater number of rodents, divided into the following sixteen families, of which only five are represented in India.

A. Angular portion of mandible arising from lower edge of bony socket of incisor.

a. Fibula distinct; zygomatic arch slender, chiefly formed by malar, which is not supported by a long maxillary process beneath it

Skull with distinct postorbital processes; pm. $\frac{2}{1}$

SCIUROMORPHA.

1. *Sciuridæ*.

Anomaluridæ (Africa).

Haplodontidæ

(N. America).

Castoridæ (N. Europe,
Asia, and America).

b. Fibula united to tibia; zygomatic arch slender; the malar rarely extending far forwards and usually supported by a long process from the maxillary; no postorbital processes

MYIOMORPHA.

a'. Form slender, hind limbs greatly elongate, metatarsals often united; infraorbital foramen very large, rounded; tail long, hairy.

b'. Infraorbital foramen large, usually high, narrow below; lower root of zygomatic maxillary process flattened

2. *Dipodidæ*.

3. *Muridæ*.

- c'. Form heavy, cylindrical, mole-like; limbs short, tail short or rudimentary; infraorbital foramen small, lower maxillary zygoma-root not flattened 4. Spalacidæ.
 Myoxidæ (Palearctic and Africa).
 Lophiomyidæ (Africa).
 Geomyidæ (America).
- B. Angular portion of mandible arising from outer side of bony socket of incisor. Fibula distinct. Zygomatic arch stout 5. Hystricidæ.
 Body more or less covered with spines. (South America.) { Octodontidæ.
 Chinchillidæ.
 Dasyproctidæ.
 Dinomyidæ.
 Caviidæ.

Family SCIURIDÆ.

The squirrels, flying-squirrels and marmots, forming the present family, are distinguished by the following characters:—Tail hairy. Skull with distinct postorbital processes; infraorbital foramen

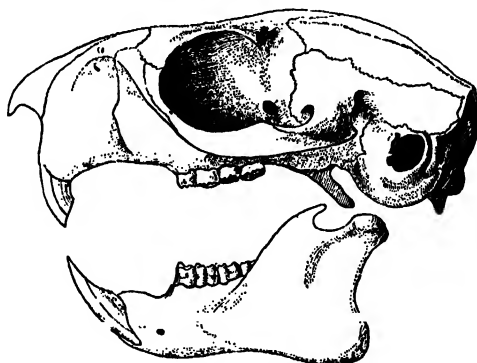


Fig. 119.—Skull of *Sciurus bicolor*, $\times \frac{3}{4}$.

small; palate broad; premolars $\frac{2-2}{1-1}$, the anterior upper premolar small, sometimes deciduous; molars rooted, tubercular in young animals, the crowns when worn exhibiting deep and often wavy folds of enamel.

There are two subfamilies thus distinguished:—

- A. Form slender, tail long, incisors compressed; chiefly arboreal *Sciurina*.
 B. Form stout, tail generally short, incisors not compressed; terrestrial *Arctomyina*.

Colour dull greyish brown to brownish grey above, paler, sometimes ashy brown, below. Feet darker, sometimes blackish brown. Basal half or more of dorsal fur leaden grey, terminal portion whitish brown with a dusky ring near the end. Ventral fur ashy with whitish-brown tips.

Dimensions not accurately known. Skins measure, head and body about 18 inches, tail with hair about 22; basal length of skull about 2.7, zygomatic breadth 1.8.

Distribution. Gilgit, about 6000 feet; probably also found at higher elevations. A skin was obtained by the late Mr. Mandelli, probably from some part of Tibet.

Habits unknown. The blunt claws probably show that the animal lives on rocks, perhaps amongst precipices, whilst the dense fur indicates a very cold climate.

Genus *PTEROMYS*, Cuv. (1800).

Limbs united by a membrane or parachute extending to the toes and supported by a bony cartilage attached to the ulnar (outer) side of the wrist, and usually long enough when laid back to extend to the elbow or beyond. There is an antebrachial



} pm.

} m.

membrane from the fore limb to the side of the neck, and an interfemoral membrane extending down the hind limb to the heel, and attached to the first two or three inches of the tail, which is bushy, cylindrical, and as long as the head and body or longer. Fur soft and rather long on the back.

Dentition: i. $\frac{2}{2}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3}$, as in *Sciurus*;

Fig. 121.—Right upper cheek-teeth of *P. magnificus*. $\times \frac{1}{4}$.

molars large, crowns much complicated. Ventrals (in *P. magnificus*): C. 7, D. 12, L. 7, S. 3, C. 30. Three pairs of mammae, pectoral and ventral, none inguinal.

The large flying-squirrels constituting this genus comprise several closely allied forms, some of which are probably not entitled to specific rank. The following occur within our area. All flying-squirrels are, so far as is known, nocturnal animals.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Lower surface white or grey, upper brown. . . *P. oral*, p. 361.

B. Lower surface rufous; no white spots on back.

a'. Head above coloured like the back.

a". A short clearly defined black tip to tail.

a'''. Back paler in colour than parachute. *P. inornatus*, p. 363.

b'''. Back deeper in colour than parachute. *P. magnificus*, p. 364.

- b". Tail-tip not black, or long and ill-defined *P. yunnanensis*, p. 364.
 b'. Head much greyer than back *P. caniceps*, p. 365.
 C. Lower surface rufous; white spots on back.. *P. punctatus*, p. 365.

227. *Pteromys oral*. *The large brown Flying-Squirrel.*

Pteromys philippensis?, Gray *apud Elliot, Madras Jour. L. S.* x, p. 217 (1839).

Pteromys oral, Tickell, *Calc. Jour. N. H.* ii, p. 401, pl. xi (1842); Kelaart, *Prod.* p. 55; Anderson, *An. Zool. Res.* p. 279; Sterndale, *Jour. Bombay N. H. Soc.* i, p. 70.

Pteromys petaurista, Pallas, *Blyth, J. A. S. B.* xvi, p. 865, xxviii, pp. 276, 286; *id. Cat.* p. 94; Jerdon, *Mam.* p. 174; nec *Sciurus petaurista*, Pallas.

Pteromys petaurista, var. *cineraceus*, *Blyth, J. A. S. B.* xvi, p. 865.

Pteromys cineraceus, *Blyth, J. A. S. B.* xxviii, p. 276; *id. Cat.* p. 94; *id. Mam. Birds Burma*, p. 35; Anderson, *An. Zool. Res.* p. 281; Blanford, *J. A. S. B.* xlvii, pt. 2, p. 165. . . .



Fig. 122.—*Pteromys oral*.

Ural, Kol.; Pakya, Mahr.; Parachaten, Mal.; Egala-dandolena, Cing.; Shu-byan, Burmese.

Ears moderate, covered with short hair that becomes longer

towards the base outside; a large tuft of long hair behind each ear. On the fore foot are 3 toe- and 2 subequal metacarpal pads; on the hind foot 4 toe-pads, a large pyriform inner metatarsal pad, and a small supplementary pad behind the outer toe-pad.

Colour above grizzled brown, varying from deep chestnut to greyish brown in one direction and to sooty black in the other, the longer hairs partly white, producing a hoary appearance, especially on the head and body, less on the membrane and limbs; dorsal fur dark ashy blackish or brown towards the base, then brown or deep red or black, the longer hairs white for a distance near the end, extreme tips black. Feet dark, often black; tail sometimes black, brownish towards the base, in other skins light or dark grey with a black tip. Lower parts white, sometimes pure, more often greyish or brownish, especially on the membrane and around the vent.

Dimensions. Head and body 16 to 18 inches; tail without hair 22, with hair 24 to 25. Some published measurements are longer. Hind foot without claws 2.75 to 3; weight 5 lbs. A skull measures 2.5 in basal, 2.85 in extreme length, and 1.9 in zygomatic width.

Distribution. All the larger forests of the Indian Peninsula south of the Ganges, also Ceylon, and throughout Burma to Tenasserim and the Mergui Archipelago.

Varieties. The ordinary Indian form is dark brown, with the greater part of the tail black. *P. cineraceus*, the Burmese form, is much greyer, the upper parts ashy throughout, and the white speckling more conspicuous on the parachute than is usually the case in Indian skins. The tail too is grey or whitish, the hairs having long white terminations, the tip of the tail alone being black. Ceylonese skins from Kandy, however, are quite intermediate, and so is one sent to me by Mr. Daly from the Shevaroy hills. Travancore specimens often have the upper surface of the membrane bright chestnut. Bombay skins, on the other hand, are said by Sterndale to be grey.

Habits. The large Indian flying-squirrel lives in holes of trees during the day and comes out to feed, as a rule, quite in the dusk. It inhabits tree-forest, but in forest-tracts it may be found about villages, in mango-groves and similar places. It feeds like ordinary squirrels on fruits and nuts, also, according to Tickell, on the bark of certain trees, and on beetles and larvæ, but not on grain. It drinks by lapping. The voice is described by Tickell as a low soft monotone quickly repeated.

The flying-squirrel sleeps during the day, sitting, like so many arboreal mammals, with its back bent into a circle and its head thrust inside; or, in hot weather, lying on its back with the parachute extended. It is not so active as other squirrels, either on trees or on the ground, the parachute impeding its movements. When passing from one tree to another at a distance, it leaps, with its parachute extended, from the higher branches, and descends, at first more directly, then, apparently, by availing itself of the resistance of the air, more and more obliquely, until its flight, gradually

growing slower, becomes horizontal and finally terminates in an ascent to the trunk or branch of the tree to which its flight is directed. The movement of a flying-squirrel through the air must be similar to that of *Galeopithecus*, and in both cases the power of directing and, so to speak, steering its course must be possessed by the animal. Jerdon states that he has seen *P. oral* traverse a distance of sixty yards from tree to tree, and McMaster records a flight across the Prome road, near Rangoon, of nearly eighty yards.

Flying-squirrels are said to breed in holes of trees, but very little is known of the breeding-habits. These animals are easily tamed, but they are delicate, and but rarely live long in confinement. Most of the above details are from Tickell.

The name *philippensis* must have been given to the present species under the supposition that a Philippine flying-squirrel is identical. As this is not the case, the name is misleading and cannot be used.

228. *Pteromys inornatus*. The large red Flying-Squirrel.

Pteromys albiventer, Gray, *Charlesworth's Mag. N. H.* i, p. 584, (1837); *Blyth, J. A. S. B.* xvi, p. 865, xvii, p. 84; *Anderson, An. Zool. Res.* p. 286; nec Gray and Hardwicke, *Ill. Ind. Zool.*

Pteromys inornatus, Geoffroy, *Jacquemont, Voyage*, iv, *Mam.* p. 62, *Atlas*, ii, pl. iv (1844); *Blyth, J. A. S. B.* xxviii, p. 277; *id. Cat.* p. 95; *Jerdon, Mam.* p. 176.

Pteromys magnificus, Hodgson, *apud Selater, P. Z. S.* 1872, p. 635, pl. 1, nec Hodgson.

Rusi gugar, Kashmiri.

Structure very similar to that of *P. oral* and skull of the same form. The large metatarsal pad joins the inner toe-pad on the hind foot. No supplementary pad.

Colour above chestnut, sometimes nearly uniform, sometimes the back and head much paler than the parachute, owing to the longer hairs being in part pale rufous or white. Dorsal fur at base dark ashy to blackish, then pale rufous passing into deep ferruginous, many of the longer hairs white or pale bright rufous for some distance near the end, and tipped black. Feet often black, also the orbits, whiskers, and a narrow band across the nose. Cheeks below the eyes grey or white. Tail rufous or brownish rufous, with a well-defined black tip, the hairs towards the base of the tail often with black terminations. Lower parts pale rufous.

Dimensions. Head and body 14 inches, tail 16, according to Jerdon. I believe, however, this squirrel grows nearly if not quite to the same size as *P. oral*. An adult skull is 2.85 inches long in extreme length and 1.85 broad across the zygomatic arches.

Distribution. The Western Himalayas, from 6000 to 10,000 ft., extending west to Murree, common in Kashmir and about Simla, found in Kumaon and in Nepal (Katmandu).

Habits. Precisely similar, so far as known, to those of *P. oral*. In Kashmir *P. inornatus* inhabits fir-trees and is said to hibernate.

229. *Pteromys magnificus*. Hodgson's Flying-Squirrel.

Sciuropterus magnificus, Hodgson, *J. A. S. B.* v, p. 231 (1836).

Pteromys magnificus, Blyth, *J. A. S. B.* xvi, p. 800, xxviii, p. 277; *id.* *Cat.* p. 95; Jerdon, *Man.* p. 177; Anderson, *An. Zool. Res.* p. 285.

Sciuropterus nobilis, Gray, *A. M. N. H.* x, p. 263 (1842).

Sciuropterus chrysothrix, Hodgson, *J. A. S. B.* xiii, p. 67, pl. i, fig. 1 (1844).

Surdj-bhāgat, H.; *Biyom*, Lepcha. •

Ears thinly clad, of moderate size. Skull shorter and broader than in *P. oral* and *P. inornatus*, and with the snout blunter. Hind foot as in *P. inornatus*.

Colour above varying, probably with the time of year. In *P. nobilis* or *chrysothrix*, which I suppose to be the summer garb, the body, neck, and head above are deep maroon, generally with a more or less well-marked yellow median line, commencing with a broad spot on the forehead. Sides of the neck and inner border of parachute, where it joins the body, yellowish buff, remainder of parachute rufous, often chestnut.

In the other phase, probably winter fur (*P. magnificus*), there is no median dorsal line, the body and head are chestnut above, more or less grizzled by some of the longer hairs being whitish near the tip, but the body above is always darker than the parachute. The dorsal hairs are dark ashy at the base. The feet are chestnut or black; the tail rufous with a well-defined black tip, the lower parts pale rufous.

Dimensions. Head and body 16 inches, tail 18 to 22, hind foot 3, ear $1\frac{1}{2}$; weight $3\frac{1}{4}$ lbs. Basal length of a skull 2.5, extreme length 2.8, zygomatic breadth 1.95.

Distribution. The Himalayas from Nepal eastwards and the ranges south of the Assam valley, at elevations from 6000 to 9000 feet.

Habits. So far as known similar to those of *P. oral*: Hodgson's flying-squirrel is said by Jerdon to live on acorns, chestnuts, and other hard fruits, also on young leaves and shoots. Hodgson states that *P. magnificus* breeds in the rains in hollows of trees, and that it seems to produce but a single young one. The young are tolerably independent of the mother in September, but the parachute is much less developed than in adults.

230. *Pteromys yunnanensis*. Anderson's Flying-Squirrel.

Pteromys yunnanensis, Anderson, *A. M. N. H.* (4) xvi, p. 282 (1875); *id.* *An. Zool. Res.* p. 282, pl. xxii.

Similar in form to *P. magnificus* but apparently with larger feet.

Colour above bay, the fur of the head and body more or less thickly sprinkled over with white tips, giving a hoary appearance; the white tips are almost or quite wanting on the parachute, which

is rather more rufous. Lower parts white, tinged with rufous near the parachute border and in the median line. Feet a little darker than body, not black. Tail rufous grey, becoming darker and blackish towards the end, but with no defined black tip.

Dimensions. Hind foot without claws 3.25 inches. In skins the head and body measure 18, tail 22.

Distribution. Hills south of Assam valley, extending eastward to Yunnan.

The specimen above described was from Cachar. The typical form from Yunnan has the tail black almost throughout. It is possible that this form passes into the Eastern Tibetan *P. alborufus*, to which Mr. W. L. Schlater informs me that he refers specimens from Assam and Burma.

231. *Pteromys caniceps*. *The grey-headed Flying-Squirrel.*

Sciuropterus caniceps, Gray, *A. M. N. H.* x, p. 262 (1842); *Blyth*, *J. A. S. B.* xvi, p. 866; *id. Cat.* p. 96; *Jerdon, Mam.* p. 178.

Sciuropterus senex, *Idgson, J. A. S. B.* xiii, p. 68, pl. i, fig. 2 (1843).

Pteromys caniceps, Gray, *Cat. Mam. &c. Nepal & Tibet*, 1846, p. 21;

Anderson, An. Zool. Res. p. 287.

Ears large, thin, almost naked. Skull smaller than in *P. oral* or *P. magnificus*. Metatarsal pad not in contact with toe-pad.

Colour above nearly uniform rufous-brown, the dorsal fur dark ashy at the base, then brown, pale rufous towards the end, and the tip black. Head throughout ashy grey or dull brown, finely speckled. Lower parts rufous, sometimes light chestnut, generally paler. Feet dull rusty red. Tail reddish brown like the back, the tip sometimes, not always, dusky or black.

Dimensions. Head and body 14 inches, tail without hair 16, with hair 18, ear $1\frac{1}{4}$, hind foot $2\frac{3}{4}$; weight 2 lbs. Basal length of skull 2.2, extreme length 2.6, zygomatic breadth 1.6.

Distribution. Nepal and Sikhim, ranging west as far as Landour at a lower elevation than *P. magnificus*, about 4000 to 6000 feet.

The true *P. petaurista* of Pallas (*P. nitidus* of most authors), from the Malay peninsula and islands, may extend its range to Tenasserim. *P. melanopterus* and *P. alborufus* are found in Eastern Tibet and Southern China. All are closely allied to *P. magnificus*.

232. *Pteromys punctatus*. *The spotted Flying-Squirrel.*

Pteromys punctatus, Gray, *A. M. N. H.* xviii, p. 211 (1846); *Blyth*, *J. A. S. B.* xxviii, p. 277.

Ears almost naked except towards the base.

Colour. Upper parts rich yellowish brown, darker on the head, more rufous on the parachute and limbs; back and crown with small irregular white spots, composed of hairs that are white throughout, basal portion of all other hairs on upper parts dusky. Lower parts and sides of head pale rufous, deeper towards the edge of the parachute. Tail light rufous brown throughout.

Dimensions. A much smaller animal than *P. magnificus*, head and body (in a dried skin) about 14 or 15 inches. Basal length of skull about 2 inches, zygomatic breadth 1·7.

Distribution. A male specimen was obtained by L. Fea in Kareneene, at about 4000 ft. The original type is more rufous, being bay above, and came from Malacca. I am indebted to Mr. Thomas for information about the discovery of this species in Burma.

Genus **SCIUROPTERUS**, F. Cuv. (1825).

Interfemorāl membrane rudimentary, not including any portion of the tail. Lateral membrane less broad than in *Pteromys*, and the supporting cartilage shorter, not extending to the elbow.

Dentition: i. $\frac{2}{3}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3}$, as in *Sciurus* and *Pteromys*; the molars, however, are much less complicated than in *Pteromys*, and more like those of *Sciurus*; they wear, as a rule, into very strongly marked transverse ridges. The postorbital processes of the skull are directed somewhat backwards, as in *Sciurus*. Vertebrae: C. 7, D. 12, L. 7, S. 3, C. 27 (in *S. alboniger*).

In other respects the genus resembles *Pteromys*. In some species, as *S. alboniger* and *S. lepidus*, the mammae are inguinal and ventral, in others pectoral and ventral, and always in three pairs.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. No pencils of long hair at base of ear-conch.

a. Light brown above; head and body 10 inches. *S. fimbriatus*, p. 366.

b. Hoary or blackish above; head and body 8·5. *S. alboniger*, p. 367.

c. Yellowish brown above; head and body 6. *S. sagitta*, p. 367.

d. Chestnut above; head and body 5 inches. *S. spadiceus*, p. 368.

B Pencils of hair, longer than ear, at base of conch.

a. Head and body 10-12 inches; hind foot over 2. *S. fuscicapillus*, p. 368.

b. Head and body 8 inches; hind foot 1·5. *S. pearsoni*, p. 369.

233. *Sciuropterus fimbriatus*. *The smaller Kashmir Flying-Squirrel.*

Sciuropterus fimbriatus, Gray, *Charlesworth's Mag. N. H.* i, p. 584

(1837); *id.* *P. Z. S.* 1837, p. 67; Blyth, *J. A. S. B.* xvi, p. 866;

id. *Cat.* p. 96; Jerdon, *Mam.* p. 178; Scully, *P. Z. S.* 1881, p. 204.

Pteromys fimbriatus, Anderson, *An. Zool. Res.* p. 296; Alston, *P. Z. S.* 1879, p. 665.

Ears large, bluntly pointed, thinly clad, without any pencils of long hair at their base. The fringe of soft hair to the parachute and feet well developed. Tail slightly flattened. Skull elongate. A small supplementary pad on outer side of planta behind pad of 5th toe; metatarsal pad elongate, distant from toe-pads.

Colour above on the head, body, and membrane light brown, more or less mixed with black on the back. In rare cases the

colour is rufous brown. Basal three fourths or more of the dorsal hair dark ashy, terminal portion light brown, extreme tip of longer hairs black. Lower parts white, sullied and brownish beneath the parachute. Tail brown, the hairs ashy at the extreme base, and with long black tips.

Dimensions. Head and body 10 inches long, tail without hair 10·5, with hair 12, ear outside 1·5, hind foot from heel 2·1; basal length of skull 2, extreme length 2·3, zygomatic breadth 1·4.

Distribution. Throughout the North-western Himalayas from Simla, and in all probability Kumaon to Kashmir, Gilgit, and Chitral, at considerable elevations, 6000 to 12,000 feet in Gilgit. Also found in Afghanistan, a specimen having been brought from Peiwar Kotal. This species is probably that named *S. buberi* by Blyth (J. A. S. B. xvi, p. 866) from Nijrow.

Habits. So far as is known, similar to those of *Pteromys*. Four young have been found in a female of this species.

234. *Sciuropterus alboniger*. *The particoloured Flying-Squirrel.*

Sciuropterus alboniger, *Hodgson, J. A. S. B.* v, p. 231 (1836); *Blyth, J. A. S. B.* xvi, p. 866; *id. Cat.* p. 97; *Jerdon, Mam.* p. 179; *Thomas, P. Z. S.* 1886, p. 59.

? *Pteromys leachii*, *Gray, Charlesworth's Mag. N. H.* i, p. 584 (1837).

Sciuroptera turnbulli, *Gray, P. Z. S.* 1837, p. 68; *Blyth, J. A. S. B.* xii, p. 928.

Pteromys alboniger, *Anderson, An. Zool. Res.* p. 298.

Ears large, thinly clad, without pencils at the base. Tail flat, distinctly distichous; hair on lower surface stiff. No supplementary pad on planta. Incisors pale yellow.

Colour above greyish brown, varying to rufous-brown, but hoary or much mixed with black from the dark underfur; the base of the hairs ashy passing gradually into black, only the ends light brown or grey, some of the longer hairs with black tips. Feet dark brown. Lower parts white; the fur dark grey at the base. Tail brown, the hairs frequently black-tipped. Young animals are black above, white below.

Dimensions. Head and body of a large specimen 11 inches long, tail without hair 8·25, with it 9; weight 9 oz.; others measure less. Extreme length of skull 1·9, zygomatic breadth 1·2.

Distribution. The Himalayas from Nepal eastward, at an elevation of 3000 to 5000 feet. Found also in the hills south of Assam, in Manipur, Yunnan, and Siam. Some skins in the British Museum from Borneo are also referred to this species.

235. *Sciuropterus sagitta*. *Horsfield's Flying-Squirrel.*

Sciurus sagitta, *L. Syst. Nat.* i, p. 88 (1766).

Pteromys horsfieldii, *Waterhouse, P. Z. S.* 1837, p. 87; *Anderson, An. Zool. Res.* p. 290.

Sciuropterus horsfieldii, *Cantor, J. A. S. B.* xv, p. 253.

Sciuropterus sagitta, *Blyth, J. A. S. B.* xxiii, p. 731, xxiv, p. 187, xxvii, p. 281; *Thomas, P. Z. S.* 1886, p. 75.

Sciuropterus phayrei, *Blyth, J. A. S. B. xxviii*, p. 278 (1859); *id. Cat. p. 97*; *id. Mam. Birds Burma*, p. 35.

Ears large, without pencils of hair at the base. Tail flat and distichous. Fur short and dense.

Upper parts throughout brown with a yellow tinge, the head coloured precisely like the back, and the tail scarcely differing. Fur ashy at the base, still darker on the parachute. Lower parts white or yellowish white. Tail brown above, redder beneath.

Dimensions of an adult male in spirit: head and body 6.25 inches, tail without hair 5, hind foot 1.25.

Distribution. Southern Pegu, Tenasserim, Cambodia, the Malay Peninsula, Java, and some of the other Malay islands. The most northern locality recorded is Shwe Gyeng, on the Sittoung River.

236. *Sciuropterus spadiceus*. *The pigmy Flying-Squirrel*.

Sciuropterus spadiceus, *Blyth, J. A. S. B. xvi*, p. 867, pl. xxxvi, fig. 1 (1847); *id. Cat. p. 97*; *id. Mam. Birds Burma*, p. 35.

Pteromys spadiceus, *Anderson, An. Zool. Res. p. 300*.

Kywek-shu-pyan, Arrakan.

Size very small. No pencils of hair at the base of the ears; tail distichous, flat, acuminate. Metatarsal pad oval.

Colour above chestnut, basal three fourths of dorsal fur sooty black, tips red. Membranes and limbs darker, tail dark brown, rufous below near the base. Lower parts white.

Dimensions. Head and body about 5 inches, tail $4\frac{1}{2}$, tarsus $1\frac{1}{4}$. Skull 1.25 inches long (extreme length), zygomatic breadth 0.8.

Distribution. Arrakan, Moulmein, and Cochin China.

Thomas, P. Z. S. 1886, p. 75, advocates the amalgamation of *S. spadiceus* with *S. lepidus*, a very small Javan form. There appears to me, however, too much difference in colour and in the form of the tail, which in *S. lepidus* is webbed like a feather.

227. *Sciuropterus fuscicapillus*. *The small Travancore Flying-Squirrel*.

Sciuropterus fuscicapillus, *Jerdon, Blyth, J. A. S. B. xvi*, p. 867 (1847), xxviii, p. 286; *id. Cat. p. 97*; *Jerdon, Mam. p. 180*.

Sciuropterus layardi, *Kelaart, Blyth, J. A. S. B. xx*, p. 165 (1851); *Kelaart, Prod. p. 56*.

Pteromys fuscicapillus, *Anderson, An. Zool. Res. p. 294*.

A pencil of soft hairs, greatly exceeding the ear in length, at each base of the ear-conch, which is short and almost naked. Tail flat, bushy. Metatarsal pad very elongate, no supplementary outer pad. Fur long, soft. Skull broader than that of *S. fimbriatus*.

Colour above reddish brown, the dark underfur showing, especially on the parachute. Dorsal hair dark ashy at the base and for the greater part of its length, becoming blackish towards the end; terminal portion rufous-brown, extreme tips of longer hairs black. On the parachute the hairs, except the brown tips, are black throughout. Sides of face whitish. Feet pale rufous-brown.

Lower parts rufescent white, the hairs dark grey near the skin. Tail rufous-brown, the hairs sometimes with black terminations. The extreme tip of the tail is sometimes white.

Dimensions. Head and body of an adult male in spirits 12 inches, tail without hair 9, with hair 10·5, hind foot 2·1, ear from crown 0·8, extreme length of skull 2·25, zygomatic breadth 1·45. Some individuals are possibly larger.

Distribution. Hills of Travancore and Ceylon, at moderate elevations. Anderson also gives the Nilgiris as a locality.

238. *Sciuropterus pearsoni*. *The hairy-footed Flying-Squirrel.*

Sciuropterus pearsonii, Gray, *A. M. N. H.* x, p. 263 (1842); Thomas, *P. Z. S.* 1886, p. 60.

Sciuropterus villosus, Blyth, *J. A. S. B.* xvi, p. 866 (1847); *id.* *Cat.* p. 96; Jerdon, *Mam.* p. 179.

Pteromys pearsonii, Anderson, *An. Zool. Res.* p. 293.

A pencil of soft hairs, greatly exceeding the ear in length, at each base of the ear-conch, which is small and fairly well clad. Tail flat, bushy. Toes with long hair, partly concealing the claws. No supplementary pad on planta; metatarsal pad oval. Fur long.

Colour above brown, frequently rufous-brown, grizzled by pale tips; dorsal hair sooty black for the greater part of its length, becoming ashy at the base, and tipped with ferruginous red, pale rufous, or light brown; extreme tip of some of the longest hairs black. Fur on upper surface of parachute black, with but few pale tips. Feet paler. Lower parts fulvescent white; more rufous, and sometimes brown or ferruginous beneath the parachute. Tail rufous-brown, paler below, sometimes tipped blackish.

Dimensions. Head and body 8 inches, tail 8, ear 0·6, hind foot and claws 1·5; zygomatic breadth of skull 0·9.

Distribution. Sikhim, Bhutan and the Eastern Himalayas, Assam, hills south of Assam, Cachar, Manipur, and Yunnan; also, according to Anderson, Formosa. In Sikhim this species inhabits a zone from 3000 to about 6000 feet.

Genus *SCIURUS*, L. (1766).

Limbs free, not connected by membrane; tail long, bushy. Hind feet with five toes, fore feet with four toes and a rudimentary thumb. No cheek-pouches.

Dentition: i. $\frac{2}{2}$, pm. $\frac{2-2}{1-1}$, m. $\frac{3-3}{3-3}$. Anterior upper premolar soon lost in some species, but not in others. Postorbital processes moderate, and generally directed backwards. The small infraorbital foramen is in front of the zygoma-root, and close to the anterior premolar. Palate broad and flat. Vertebrae: C. 7, D. 12-13, L. 6-7, S. 3, C. 21-32.

Squirrels are mainly arboreal and diurnal, they feed on fruit, seeds, nuts, leaf-buds, and sometimes it is said on insects and birds' eggs. They hold their



Fig. 123.—Right upper cheek-teeth of *S. erythraeus*, $\times 2$.

food between their fore feet when eating. They build large nests of leaves, grass, &c. in trees, and usually produce three or four young. The Indian and Burmese species are numerous, but fall into three groups, easily recognized by size and other characters.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Large squirrels; nose to vent not less than 12 inches; lower surface of tail with short hair; usually 4 teeth in upper molar series on each side.
- a. Outside of all limbs coloured like upper parts, which are generally blackish. *S. bicolor*, p. 373.
 - b. Outside of hind limbs like back, wholly or partly maroon, of fore limbs buff like abdomen *S. indicus*, p. 371.
 - c. Outside of all limbs pale like abdomen. *S. macrurus*, p. 374.
- B. Medium-sized squirrels; nose to vent 7 to 10 inches; lower surface of tail with long hair; no pale longitudinal bands on back or sides; usually 5 teeth in upper molar series.
- a. Colour throughout body above and below red or reddish brown *S. ferrugineus*, p. 375.
 - b. Colour not uniform, back finely speckled.
 - a'. Longer dorsal hairs with but one pale ring; a small white or whitish spot behind each ear.
 - a''. Abdomen rufous *S. locria*, p. 376.
 - b''. Abdomen white *S. rufigenis*, p. 376.
 - b'. Longer dorsal hairs with two pale rings; no white spots behind ear.
 - a''. Neither a black dorsal patch nor white whiskers.
 - a³. Abdomen chestnut or bay . . . *S. erythræus*, p. 377.
 - b³. Abdomen longitudinally banded white and black *S. quinquestriatus*, p. 378.
 - c³. Abdomen pale rufous or isabelline or grey.
 - a⁴. A distinct black tail-tip.
 - a. A black or blackish band on each side of abdomen *S. phayrei*, p. 379.
 - β. No black lateral bands.
 - a'. Abdomen pale rufous. *S. pygerythrus*, p. 379.
 - β'. Abdomen pale grey . . *S. caniceps*, p. 380.
 - b⁴. Either no black tail-tip or a very ill-defined one.
 - a. Feet whitish. *S. griseimanus*, p. 381.
 - β. Feet the same colour as the sides *S. locroides*, p. 381.
 - b''. Either a black dorsal patch or white whiskers, or both * *S. atridorsalis*, p. 382.

* A rufous variety of this occurs with black whiskers, and no black on the back. This is scarcely distinguishable from some forms of *S. erythræus*.

- O. Small striped squirrels; nose to vent 5 to 7 inches; back with pale longitudinal bands; upper cheek-teeth generally 5.
- a. A pale line in middle of back; ears not pencilled.
- a'. Pale dorsal stripes distinct, extending throughout the back.
- a''. Pale stripes subequal, each more than $\frac{1}{10}$ inch broad; skull 1.8 inch long *S. palmarum*, p. 383.
- b''. Pale stripes subequal, each less than $\frac{1}{10}$ inch broad; skull 1.55 inch long *S. tristriatus*, p. 384.
- c''. Middle pale stripe broader and much more distinct than lateral
- b'. Pale dorsal stripes narrow, indistinct, confined to the middle of back *S. sublineatus*, p. 385.
- b. A black line in middle of back; head and body 5 inches; ears pencilled. . . *S. macclellandi*, p. 386.
- c. No pale line in middle of back; head and body 7 inches; ears not pencilled *S. bermorei*, p. 387.

The group of medium-sized squirrels contains so many variable races, and intermediate forms between some of them are so frequently met with, that the key here given may not always suffice to distinguish individual specimens. It is doubtful whether some of the small striped squirrels have any genetic connexion with the others similarly marked.

239. *Sciurus indicus*. *The large Indian Squirrel.*

- Sciurus indicus*, *Erxleben, Syst. Regn. An.* p. 420 (1777); *Anderson, An. Zool. Res.* p. 222; *Thomas, P. Z. S.* 1886, p. 60.
- Sciurus purpureus*, *Zimmermann, Spec. Zool. Geog. Quad.* p. 518 (1777); *Blyth, J. A. S. B.* xvi, p. 868.
- Sciurus malabaricus*, *Scopoli, Del. Faun. Flor. Ins.* ii, p. 85 (1786); *Schinz, Syn. Mam.* ii, p. 32; *Jerdon, Mam.* p. 166.
- Sciurus maximus*, *Schreber, Säugth.* iv, p. 784, pl. ccxvii B (1784); *Elliot, Mad. Jour. L. S.* x, p. 217; *Blyth, J. A. S. B.* xxviii, p. 287; *id. Cat.* p. 98; *Jerdon, Mam.* p. 166; *Bull, P. A. S. B.* 1877, p. 170; *Anderson, An. Zool. Res.* p. 223.
- Sciurus elphinstonii*, *Sykes, P. Z. S.* 1831, p. 103; *Jerdon, Mam.* p. 167.

Karrát, Rasu, Ratuphar, Jangli gilheri, H.; *Kát berral*, Beng.; *Hondeng*, Kol.; *Shekra*, Mahr.; *Kes annalu*, Can.; *Bet udata*, Tam.

Ears with long dense tufts. Skull with the muzzle broader and teeth larger than in *S. bicolor*.

Colour. The upper parts, including the ears and nape, are either wholly ferruginous red (rich chestnut or maroon), or the red is more or less replaced by black on the shoulders, middle of the back, rump, thighs, and tail. There is always a pale band across

the vertex just in front of the ears; the forehead is chestnut or rufous-brown, or pale brown, frequently more or less grizzled with white. Sides of the head and muzzle yellowish brown or buff, sometimes with a rufous tinge. A chestnut stripe down the side of the neck from in front of the ear. Lower parts buff or yellowish brown. Dorsal fur blackish or dark brown near the skin, ventral dusky. In specimens wholly or chiefly red above, the terminal portion of the tail, from a quarter to more than half, is sullied white or buff, and the lower surface of the tail is pale throughout; in darker skins the lower surface of the tail is dull red or brown.

Dimensions. Head and body 16 to 18 inches; tail rather less, or, with hair, one or two inches more. In a Malabar specimen, head and body 17 inches, tail 14.5; weight 4½ lbs. Basal length of a skull 2.6 inches, zygomatic breadth 1.8. The Bombay variety, with back and tail entirely red, appears rather smaller than the Malabar and Bengal forms.

Distribution. Throughout the Peninsula of India, south of the Ganges, Soane, and Nerbudda, in all extensive forests, and also to the eastward in Manipur, so this squirrel should be looked for in Cachar, Chittagong, Tipperah, &c. Hodgson once (P. Z. S. 1855, p. 126) incidentally mentioned *S. purpureus* amongst the mammals of the Nepal Terai; but as no such animal is comprised in his lists of Nepal mammals, and no specimen exists in his collections, the name was doubtless inserted in error. *S. indicus* is common in Orissa, Bastar, and parts of Chutia Nagpur, also in the Western Ghâts.

Varieties. This species was divided into three by Jerdon, and into two by Anderson. I think all the three forms distinguished by the first-named well marked races. They are:—

1. The Bombay Squirrel of Pennant, from which *S. indicus* and *S. purpureus* were named, and which was subsequently called *S. elphinstonii*. All the upper parts are red, no black occurring; tail-tip whitish. This appears rather smaller than other varieties, and inhabits the northern part of the Western Ghâts, but has been obtained by Sir O. B. St. John as far south as Mysore.
2. *S. maximus* of Jerdon, not of Schreber. This is chiefly red above, but there is some black on the shoulders and upper part of the tail, the tip of which is usually yellowish. This race, which has no special name, is found in Orissa, Bastar, Chutia Nagpur, South-western Bengal, and Manipur.
3. *S. malabaricus* or *S. maximus* (both founded on Sonnerat's Great Malabar Squirrel). Shoulders, rump, and tail, with more or less of the back, black. This is found in Southern Malabar and parts of Central India. There is a specimen in the British Museum from the source of the Nerbudda.

Habits. The large red squirrel inhabits high trees in forests,

living amongst the branches and rarely coming to the ground. It makes a large nest of twigs and leaves near the top of a lofty tree. A tame animal kept by Mr. Sterndale made nests in several trees, and the same animal was observed to jump 20 feet from one tree to another. This squirrel moves about and feeds at all hours of daylight, except perhaps the middle of the day. The voice is a loud quickly repeated cry. Young animals are easily tamed, but are not very docile or intelligent.

240. *Sciurus bicolor*. *The large Malay Squirrel.*

Sciurus bicolor, *Sparman, Gotheb. Vet. Svensk. Handl.* i. p. 70 (1778); *Blyth, J. A. S. B.* x, p. 919, xvi, p. 870; *id. Cat.* p. 99;

Cantor, J. A. S. B. xv, p. 246; *Anderson, An. Zool. Res.* p. 215.

Sciurus giganteus, McClelland, P. Z. S. 1839, p. 150; *Anderson, An. Zool. Res.* p. 220.

Sciurus macruroides, Hodgson, J. A. S. B. x, p. 915 (no description); *Jerdon, Mam.* p. 168; *Blyth, Mam. Birds Burma,* p. 35.

Shingsham, Bhot.; *Satheu, Lepcha*; *Leng-theh, Arrakan*; *Sheng, Sheng apan, Burmese*; *Chingkrawah, Malay*; *Meng-khan, Talain*; *Khabong, Karen.*

Mammæ 6, all inguinal.

Colour. All the upper parts, the outside of all limbs, and tail black or brownish black or brown, lower parts to the vent buff. The dark colour of the face extends around the eyes and ears; a stripe extends backward and downward from the nose behind the gape and below the eye, and there is a dark spot on the chin. Fur of the same colour throughout above; the basal portion of the hairs is dusky below, and becomes conspicuous when the fur is worn.

Dimensions. In the Himalayan form the head and body measure about 16 inches, tail without hair 17 to 22, hair at the end 3 to 4 inches more, hind foot 3.5; basal length of skull 2.75, zygomatic breadth 1.9; weight 4½ lbs. In a very large individual, according to Cantor, the head and body measured 18 inches, tail 21.5.

Distribution. The Eastern Himalayas of Nipal, Sikhim, and Bhutan, also all the hill-regions and large tree-forests of Assam, Manipur, Burma, Siam, the Malay Peninsula, Sumatra, Java, Borneo, and even, it is said, Celebes.

Varieties. In the Malay Peninsula and Islands there are several races of this squirrel, to many of which names have been given, and the coloration of which varies greatly, one Malaccan variety having a whity-brown (*café au lait*) colour above throughout, whilst others are varied in tint, and some grizzled. The hairs of the tail are often white at the base or at the tips. In the Irrawaddy delta, and perhaps in Martaban and Tenasserim, a variety is common with a broad pale band or patch across the back. The worn summer fur is often paler brown, wholly or in patches, the fresh

winter coat nearly black. There is, moreover, much variation in size, Himalayan squirrels being largest, whilst many of the Malay forms are considerably smaller. The distinction, however, upon which most stress has been laid is the presence or absence of ear-tufts. All Himalayan and Arrakan specimens have, on the outside of the ear-conch, a tuft of long hairs, which is wanting in other Burmese skins, especially those from Tenasserim, and in Malaccan specimens. But there are gradations; and squirrels of this species with tufted ears are recorded even from Borneo. It should be remembered that the common European squirrel has tufted ears in winter, but not in summer. The difference in the two races of *S. bicolor* is, probably, due to habitat, the form inhabiting colder countries, such as the Himalayas, having tufted ears. Anderson, Jentink, and others distinguish the larger form with tufted ears as *S. giganteus* (*S. macruroides* of other writers).

Habits. Very similar to those of *S. indicus*. This species inhabits high trees, generally in pairs. It feeds on fruits and nuts of various kinds, and is said by Tickell to eat birds' eggs and insects. The voice, according to the same observer, is a loud harsh cackle.

241. *Sciurus macrurus*. *The grizzled Indian Squirrel.*

*Sciurus macrurus**, *Pennant, Indian Zoology*, pt. 1, pl. i (1769), *teste Erxleben, Syst. Regn. An.* p. 420; *Blyth, J. A. S. B.* xvi, p. 869, pl. xxxvi, fig. 2, xviii, p. 601, xx, p. 165; *id. Cat.* p. 100; *Kelaart, Prod.* p. 49; *Jerdon, Mam.* p. 168; *Anderson, An. Zool. Res.* p. 224.

Sciurus ceylonicus, Erxleben, Syst. Reg. An. p. 416 (1777).

Sciurus tennantii, Layard, Blyth, J. A. S. B. xviii, p. 600 (1849), xx, p. 165; *id. Cat.* p. 100; *Kelaart, Prod.* p. 50.

Rukiya, Dandolena, Cingalese; *Peria-anathan*, Tamul.

Ear sometimes very slightly tufted, sometimes not.

Colour. Upper surface and tail grey or brownish grey, more or less grizzled with white, especially on the sides and tail, except in the variety *S. tennantii*, in which the upper parts and tail are quite black. A pale band across the crown of the head between the ears. Lower parts with the whole forearm and lower parts of tibia all round buff or whitish. Forehead dark, generally black or blackish; sides of head and end of muzzle pale; ears usually dark, but not always. A black streak behind the eye down the side of the neck, often indistinct, but sometimes double. Toes and sometimes the whole feet black. Terminal portion of tail occasionally with long white tips to the hairs. Basal half of dorsal fur dark brown, of ventral dusky.

* *S. macrurus*, Gray and Hardwicke, Ill. Ind. Zool. ii, pl. xix, is not this species, but, I think, a variety of *S. bicolor*. *S. albipes*, Blyth, J. A. S. B. xxviii, p. 287, though referred to *S. macrurus* by Anderson, is also, I think, *S. bicolor*.

Dimensions. Head and body 13 to 15½ inches, tail rather less, or with the hair rather more. Basal length of skull 2.15, width across zygomatic arches 1.6.

Distribution. Ceylon and the Southern part of the Indian Peninsula, in forests, especially hill-forest. The most northerly localities known are the Shevaroy Hills (whence skins have been sent to me by Mr. Daly), Mysore, and the Nilgiris.

Varieties. The colour varies considerably, and according to Kelaart changes from dark brown to grizzled grey with the seasons, but the only race deserving of notice is that called *S. tennantii* by Layard. This is peculiar to the higher ranges in Ceylon, is decidedly larger in size than typical *S. macrurus*, and has the upper parts, tail, and toes perfectly black, some white tips being occasionally, not always, found on the hair of the tail. Forearm and tibia outside and inside coloured like the abdomen as usual.

I can find nothing especial recorded of the habits.

242. *Sciurus ferrugineus*. The bay Squirrel.

Sciurus ferrugineus, *F. Cuv. Hist. Nat. Mam.* pl. 238 (1829); *Blyth, J. A. S. B.* xxxi, p. 332; *id. Cat.* p. 101; *id. Mam. Birds Burma*, p. 36; *Anderson, An. Zool. Res.* p. 243; *M.-Edwards, Bull. Soc. Philom.* sér. 7, i, p. 16.

Sciurus keraudrenii, *Reynaud, Lesson, Cent. Zool.* p. 11, pl. i (1830); *Blyth, J. A. S. B.* xvi, p. 872, xxiv, p. 474; *Blanford, J. A. S. B.* xxxi, p. 194.

Colour rich ferruginous red almost throughout, varying from bright to deep chestnut and to brownish red, the middle of the back sometimes darker, the paws occasionally blackish, and the end of the tail in one variety white.

Dimensions. Head and body 8 to 10 inches, tail without hair 9 to 12, with hair 11 to 15, hind foot 1.85 to 2.1. The large dimensions are from a Bhámo specimen, the smaller from a Rangoon one preserved in spirit.

Distribution. Throughout Upper Burma, Arrakan, Pegu, and Siam, but not recorded from Martaban or Tenasserim. Common near Rangoon. I have a skin of a rusty-red squirrel from Sikhim which may belong to the present species.

Varieties. In Burma the variation in this squirrel is only from bright chestnut to brownish red, but Anderson and others unite with this form the white *S. finlaysoni* from Siam, the jet-black *S. germani* from the island of Sichang, and other forms, some of them grizzled brown. If *S. finlaysoni* be really identical, the name which was given by Horsfield, in his 'Zoological Researches in Java,' published in 1824, has priority over *S. ferrugineus*. See Anderson, l. c.

243. *Sciurus lokria*. The orange-bellied Himalayan Squirrel.

Sciurus lokriah, Hodgson, *J. A. S. B.* v, p. 232 (1836); *Blyth, J. A. S. B.* xvi, p. 873, xxiv, p. 475; *id. Cat.* p. 104; *id. Mam. Birds Burma*, p. 37; *Jerdon, Mam.* p. 169; *Anderson, An. Zool. Res.* p. 250

Sciurus locria, Hodgson, *J. A. S. B.* x, p. 915.

Sciurus subflaviventris, MacClelland, *Gray, List Mam. B. M.* p. 144 (1843), no description; *Horsfield, Cat.* p. 152.

Lokria, Nepal; *Zhamo*, Bhot.; *Kallior* *Kalli ting-dong*, Lepcha.

Tail shorter than the head and body. Snout elongate, narrow. Teeth small. Length of the five upper molars together about half that of the nasals. Three pairs of mammae, 1 pectoral, 2 inguinal.

Colour above usually dark rufous-brown, slightly speckled, sometimes speckled dark yellowish brown, sides a little paler. *Dorsal fur* leaden black at the base, the longer hairs having a single yellow ring and a long black tip. A white or whitish patch behind each ear, often concealed by the conch. Lower parts from chin to vent more or less orange, varying from pale to bright rusty red; the rufous colour is often confined to the middle of the abdomen, and passes gradually into the brown of the sides. Tail not distinctly annulated, blackish or dark brown throughout, sometimes hoary, the hair whitish or pale rufous at the base, then deeper rufous, a dusky ring intervening sometimes, the terminal portion black, sometimes with the extreme tip white.

Dimensions. Head and body 8 inches, tail without hair 5·75, with hair 8·25; basal length of skull 1·2, extreme length 2, zygomatic breadth 1·1. Weight 7 ounces.

Distribution. Nepal, Sikhim, and hills north and south of Assam, Manipur, and Arrakan. This species occurs chiefly, perhaps exclusively, at some elevation above the sea, in Sikhim up to 7000 or 8000 feet.

This squirrel may be distinguished from *S. locroides* by its longer and more pointed nose and smaller molars, by having one yellow ring instead of two on the longer dorsal hairs, by the whitish patch behind the ear, and by the want of distinct annulation in the tail-hairs, also generally by being more rufous above and below. To the same peculiar group as *S. lokria* belong *S. pernyi* and *S. rufigenis*, the three being in fact little more than local races of the same species.

244. *Sciurus rufigenis*. The red-cheeked Squirrel.

Sciurus rufigenis, *Blanford, J. A. S. B.* xlvii, pt. 2, p. 156, pls. vii, viii (1878); *Thomas, P. Z. S.* 1886, p. 71.

Tail without hair considerably shorter than the head and body. Snout elongate, pointed. Much woolly underfur mixed with the hair on the back.

Colour above and on sides of body a fine mixture of yellow and black, the general tint speckled yellowish brown, darker in the middle of the back. Dorsal hairs dark slaty at the base, then

black with one pale yellow ring near the end. A distinct whitish spot behind each ear, often concealed by the conch. Muzzle rufous; cheeks bright ferruginous red, vibrissæ black; chin and fore neck white, sometimes more or less tinged with rufescent; breast and abdomen purer white, the hairs dusky at the base. Tail nearly black above, rich ferruginous below, the hairs on the upper surface black with one white ring near the base and white tips; on the lower surface, chestnut with long black white-tipped terminations. The red beneath the tail extends around the vent and to the back of the thighs.

Dimensions. Head and body 8 inches, tail without hair 6·5 with hair 7·8, hind foot 1·8; extreme length of skull from occiput to end of nasals 2·1, basal length about 1·75, zygomatic breadth 1·2.

Distribution. The sides of Muleyit mountain about 70 miles east of Moulmein, in dense forest at an elevation of 4000 to 6000 feet. Also found in Karennee by Mr. L. Fea. An allied species, *S. pernyi*, occurs in Se-chuen, China.

245. *Sciurus erythræus*. Pallas's Squirrel.

Sciurus erythræus, Pallas, *Glinres*, p. 377 (1778); Blyth, *J. A. S. B.* xi, p. 970, xvi, p. 872, xxiv, p. 473; *id.* *Cat.* p. 102; Anderson, *An. Zool. Res.* p. 236; Thomas, *P. Z. S.* 1886, p. 61.

Sciurus hippurus, McClelland, *P. Z. S.* 1839, p. 161; Horsfield, *Cat.* p. 154, partim, nec Geoffroy.

Sciurus erythrogaster, Blyth, *J. A. S. B.* xi, p. 970 (1842), xvi, p. 871, xxiv, p. 473; *id.* *Cat.* p. 102.

? *Sciurus piceus*, Peters, *P. Z. S.* 1866, p. 429.

Macroxus punctatissimus, Gray, *A. M. N. H.* (3), xx, p. 283 (1867).

Sciurus sladeni and *S. gordonii*, Anderson, *P. Z. S.* 1871, pp. 139, 140; *id.* *An. Zool. Res.* pp. 240, 242, pls. xix, xx.

Kherwa, Manipuri.

Tail bushy, longer than head and body. Two pairs of mammae, ventral and inguinal. Soles of feet smooth, not tubercular, between the pads.

Colour above varying from almost black through speckled blackish olive to pale olive and to rufous or yellowish brown, or occasionally speckled grey. Hairs leaden black at the base, then yellow (whitish or orange) and black alternately, usually two rings of each, the tip black. Lower parts varying from rusty red to deep bay, usually rich chestnut; in some varieties the chin, fore neck, and a stripe down the middle of the abdomen are of the same speckled olive or brown colour as the sides. In some forms too the ears and muzzle, and in one race (*S. sladeni*) the head and feet, are bright ferruginous like the lower parts. The tail is either rufous throughout or annulated by each hair having six or eight alternating rings of black and grey, and the terminal portion, varying from the tip to the greater part of the tail, is either black or ferruginous red.

Dimensions. A Manipur male measured, head and body 7·5 inches, tail without hair 9·5, with hair 12. Judging from other skins, the tail may in this case have been proportionally longer than

usual. Extreme length of skull from occiput to end of nasals 2, basal length 1.75, zygomatic breadth 1.15.

Distribution. Assam, the hills to the south (Khási, Gáro, &c.), Cachar, Chittagong, Manipur, and Upper Burma; also (if, as I believe, *S. castaneiventris* is not distinguishable) China. *S. piceus* is said to be from Tenasserim.

Varieties. The following are the principal races that I include under *S. erythræus*:—

1. Typical *S. erythræus* from the Khási hills and neighbourhood. This has the upper surface light olive, lower parts chestnut, and the terminal portion of the tail, two thirds or more, coloured like the belly, the extreme tip sometimes whitish; the ears are rufous.
2. *S. erythrogaster* from Manipur. Upper surface dark olive, lower parts chestnut to bay, feet and terminal half or more of the tail black.
3. *S. punctatissimus* (and, as I believe, *S. piceus* of Peters) from Cachar. Upper parts very dark almost black, tail and feet black, lower parts dark bay.
4. *S. gordonii* from Upper Burma, north of Ava. The upper parts brown or olive, more or less rufescent; lower parts pale to deep ferruginous, with a distinct median band along the breast and abdomen coloured and speckled like the sides, the throat and fore neck sometimes speckled olive, sometimes ferruginous. Tail annulated, tip rufous or white, sometimes a black bar between the annulated part and the rufous or white tip. A very similar variety is found in Upper Assam.
5. *S. sladeni* from Thigyain, Upper Burma. Upper parts speckled rufous-olive. Head, feet, termination of the tail, and all the lower parts ferruginous red.

245. *Sciurus quinquestriatus*. *Anderson's Squirrel*.

Sciurus quinquestriatus, *Anderson*, *P. Z. S.* 1871, p. 142, pl. x; *id.* *An. Zool. Res.* p. 266; *Blyth*, *Mam. Birds Burma*, p. 37.

Posterior foot-pads on hind feet linear, soles between pads smooth.

Colour above and on the sides black and yellow or orange mixed to form a speckled brown or olive; dorsal fur leaden black at the base, then annulated with alternate rings of yellow and black, the tip black; the middle of the back often more rufous. Breast and belly white, with three longitudinal dark brown or black stripes, sometimes punctulated, one stripe median, the other two lateral between the white and the olive of the side; the white is sometimes reduced to two narrow stripes. Tail the same colour as the back except at the tip; tail-hairs annulated with yellow or whitish and black, four or five rings of each colour, terminal hairs black with white tips.

Dimensions. Head and body $9\frac{1}{2}$ inches, tail without hair 9, hind foot 1.9; basal length of skull 1.8, zygomatic breadth 1.2.

Distribution. Only obtained as yet on the Kakhien hills near Bhámo, Upper Burma.

• 247. *Sciurus phayrei*. *Phayre's Squirrel*.

Sciurus phayrei, *Blyth, J. A. S. B.* xxiv, pp. 472, 476 (1855), xxxi, p. 332; *id. Cat.* p. 104; *id. Mam. Birds Burma*, p. 36; *Peters, P. Z. S.* 1866, p. 429; *Blanford, J. A. S. B.* xlvii, pt. 2, p. 160; *Anderson, An. Zool. Res.* p. 230.

Sciurus caniceps phayrei, *Thomas, P. Z. S.* 1886, p. 69.

Colour. Upper parts speckled greyish brown, the back sometimes with a rufous tinge; dorsal hairs leaden black at the base, then isabelline and black alternately, two rings of each, the tip black. Feet and lower parts light rufous, a black or blackish band on each side of the rufous abdomen from axil to groin. Tail concolorous with the back above and at the sides; below, in the middle, at all events towards the base, pale rufous like the abdomen; tip of the tail black for one or two inches; tail-hairs generally with 4 or 5 rings of each colour, isabelline and black.

Dimensions. Head and body of a female 9·6 inches, tail, without hair 8·8, with hair 11, hind foot from heel 1·8; weight 8 oz. Basal length of skull 1·9, extreme length 2·15, zygomatic breadth 1·25.

Distribution. The province of Martaban in Burma, ranging north to the southern border of the Karennee country.

This form doubtless passes into *S. pygerythrus*, as in some skins the characteristic dark lateral bands are indistinct.

• 248. *Sciurus pygerythrus*. *The Irrawaddy Squirrel*.

Sciurus pygerythrus, *Geoffroy, Mag. Zool.* 1832, Cl. 1; *Bélanger, Voyage, Zool.* p. 145, pl. 7 (1834); *Blyth, J. A. S. B.* xvii, p. 345, xxiv, p. 475, xxxi, p. 333; *id. Cat.* p. 103; *id. Mam. Birds Burma*, p. 37; *Anderson, An. Zool. Res.* p. 227.

Sciurus blanfordi, *Blyth, J. A. S. B.* xxxi, p. 333, xxxii, p. 73; *id. Cat.* p. 104; *id. Mam. Birds Burma*, p. 36; *Anderson, An. Zool. Res.* p. 230.

Colour above speckled olive-brown to grey, below light rufous or buff. Feet sometimes buff like the lower parts, sometimes not. Dorsal hairs leaden black at the base, then white or isabelline and black alternately, usually two rings of each, the tips black. Tail coloured like the back, except the tip, which is black and well defined; tail-hairs annulated, with about four rings of each colour, whitish and black.

Dimensions. Head and body about 9 inches, tail without hair rather less; basal length of skull 1·75, extreme length 2·05, zygomatic breadth 1·25.

Distribution. Throughout the Irrawaddy valley in places from the neighbourhood of Rangoon, where it is common, to above Ava.

Varieties. *S. blanfordi*, the Ava and Upper Burma race, appears to be only a greyer form of the more olivaceous *S. pygerythrus* of Pégú.

249. *Sciurus caniceps*. *The golden-backed Squirrel.*

Sciurus caniceps, Gray, *A. M. N. H.* x, p. 263 (1842); *Blyth, Mam. Birds Burma*, p. 36; *Anderson, An. Zool. Res.* p. 220; *Blanford, J. A. S. B.* xlvii, pt. 2, p. 161; *Thomas, P. Z. S.* 1886, p. 68. *Sciurus chrysonotus*, *Blyth, J. A. S. B.* xvi, p. 873, pl. xxxvii, fig. 1, xxiv, p. 474; *id. Cat.* p. 103; *Peters, P. Z. S.* 1866, p. 429. *Sciurus concolor*, *Blyth, J. A. S. B.* xxiv, p. 474; *id. Cat.* p. 103.

Two pairs of mammae, one ventral and one inguinal, as in all allied forms. Feet very broad. Soles of all feet bearing granular tubercles between the pads.

Colour above speckled greyish olive to rufous olive, the back in the typical form changing in winter to orange or pale ferruginous red. The dorsal hairs are blackish at the base, and in the grey or olive (summer) phase the terminal portion is alternately yellow and black, 2 rings of each, the tip being black. In the orange (winter) phase all the terminal portion is orange. Head frequently pale grey. Lower parts speckled grey or olivaceous grey, often with a median dark line. In Southern specimens the flanks and sides of the neck are bright rufous. Tail indistinctly annulated, each hair coloured alternately whitish and black, usually about 4 rings of each; tip of the tail for about 2 to 3 inches black.

Dimensions of a female: head and body 8·7 inches, tail without hair 9·8, with hair 12·1, hind foot 1·2, ear 0·5. In a male the tail, without hair, is shorter than the head and body. Basal length of skull 1·95, extreme length 2·3, zygomatic breadth 1·35.

Distribution. From the neighbourhood of Moulmein, throughout the Tenasserim provinces and Malay Peninsula. Rare in Amherst.

Varieties. Two forms are included under this species, because in the ordinary summer vesture they are indistinguishable; as, however, one has a distinct breeding livery and the other has not, it is doubtful whether the two should not receive different names. These forms are:—

1. Typical *S. caniceps* (*S. chrysonotus*, Blyth), the form found in Northern Tenasserim near Moulmein. This is paler and greyer than the next variety, and both sexes in winter have the back orange. Mr. Thomas has shown, from the examination of a large series of dated specimens, that the yellow colour of the back begins to appear in patches about October, and to disappear and be replaced by grey hair about March.
2. *S. concolor*, found in Southern Tenasserim and the Malay Peninsula. This is darker in colour, both above and below, and has no seasonal change. Malay Peninsula skins have the sides of the neck and flanks rufous.

Habits. Probably precisely the same as those of all the allied forms. Beavan found the nest of this squirrel in July with one young one in it, and observed that the species occurs at times near houses, and occasionally descends to the ground to feed, but never remains there long. The breeding-time apparently is in the spring.

250. *Sciurus griseimanus*. *The grey-footed Squirrel.*

Sciurus griseimanus, A. Milne-Edwards, *Rev. Mag. Zool.* xix, p. 195 (1867); *Anderson, An. Zool. Res.* p. 233.

Colour speckled greyish brown above; dorsal hairs leaden black, at the base then whitish and black alternately, two rings of each. Feet and lower parts pale isabelline or pale fawn. Tail coloured like the back, lower surface near the base the same colour as the abdomen, occasionally a small black tail-tip; tail-hairs generally with 4 or 5 rings of each colour, isabelline and black.

Dimensions of type: head and body 10 inches, tail the same; of Burmese skins apparently somewhat less.

Distribution. Cochin China and Cambodia. A single specimen has been procured by Mr. L. Fea at Kyouk Myoung, Upper Burma.

This squirrel is nearly allied to both *S. locroides* and *S. pygerythrus*, and evidently passes into both.

251. *Sciurus locroides*. *The hoary-bellied Himalayan Squirrel.*

Sciurus lokroides, *Hodgson, J. A. S. B.* v, p. 232 (1836); *McClelland, P. Z. S.* 1839, p. 152; *Blyth, J. A. S. B.* xvi, p. 873, xxiv, p. 475; *id. Cat.* p. 104; *Jerdon, Mam.* p. 169; *Anderson, An. Zool. Res.* p. 247.

Sciurus locroides, *Hodgson, J. A. S. B.* x, p. 915.

Sciurus assamensis, *McClelland, apud Gray, List Mam. B. M.* p. 143 (1843), no description; *Blyth, J. A. S. B.* xxiv, p. 475; *id. Cat.* p. 103; *id. Mam. Birds Burma*, p. 37.

Sciurus blythii, *Tytler, A. M. N. H.* ser. 2, xiv, p. 172 (1854).

Sciurus lokrioides and *Macroxus similis*, *Gray, A. M. N. H.* (3) xx, pp. 274, 281.

Snout short. Teeth larger than in *S. locria*. The length of the upper 5 molars together is about two thirds of that of the nasal bones. Usually two pairs of mammæ, more rarely three pairs, all ventral or inguinal.

Colour of upper parts, head, body, and tail speckled olive or yellowish brown, sometimes greyish brown, sides very little paler; feet the same as the sides; lower parts isabelline or greyish or pale rufous, more rarely light rufous-brown, sometimes speckled and occasionally with a faint median band. The colour of the abdomen passes gradually into that of the sides. Dorsal hairs leaden black at the base, then alternately yellow or whitish and black, generally two rings of each colour, the tip black; tail-hairs with about four rings of each colour. The terminal hairs of the tail have sometimes longer black tips than the others, but there is never a distinct black tail-tip. Some of the abdominal hairs are occasionally annulated. There is sometimes a rufescent tinge on the sides of the body and neck.

Dimensions. Head and body 8 inches, tail without hair 7.5, with hair 9.5; weight 8 oz. Basal length of skull 1.75, extreme length 2, zygomatic breadth 1.2.

Distribution. The Eastern Himalayas, Nepal, Sikhim, and Bhutan at low elevations, Assam and the Assam hills, Cachar, Tipperah,

Chittagong, Manipur, and Arrakan; also Eastern Bengal (Dacca), Upper Burma (Bhâmo), and Prepara Island.

Varieties. The form called *S. assamensis* is scarcely distinguishable from typical *S. locroides*. There is, however, a well-marked variety found in Sikhim and further east, with the anterior surface of the thighs richly fulvous, lower parts generally grey. This is *Macroxus similis* of Gray. Anderson says that a jet-black squirrel found in Sylhet and Cachar is probably referable to the present species.

S. locroides appears to pass into *S. griseimanus* and also, I believe, into the Chinese *S. castaneoventris* through forms of the latter with little or no chestnut on the lower parts.

252. *Sciurus atridorsalis*. *The black-backed Squirrel.*

Sciurus atrodorsalis, Gray, *A. M. N. H.* x, p. 263 (1842); *Blyth*, *J. A. S. B.* xvi, p. 872, pl. xxxvii, fig. 3, xvii, p. 345, xxiv, p. 477, xxviii, p. 276, xxxi, p. 333; *id.* *Cat.* p. 105; *id.* *Mam. Birds Burma*, p. 36; *Peters*, *P. Z. S.* 1866, p. 428; *Blanford*, *J. A. S. B.* xlvii, pt. 2, p. 159; *Anderson*, *An. Zool. Res.* p. 233; *Thomas*, *P. Z. S.* 1886, p. 70.

Sciurus hyperythrus, *Blyth*, *J. A. S. B.* xxiv, p. 474; *id.* *Cat.* p. 102.

Foot broad; sole smooth, not granulated between the pads. Two pairs of mammae, ventral and inguinal.

Colour very variable. The upper surface speckled greyish or rufous brown, with generally, but not always, an elongate black patch in the middle of the back. In rufous specimens the head is distinctly ferruginous red. Dorsal hairs black at the base, then alternately yellow and black, two rings of each (or occasionally only one ring); the black hairs of the patch in the middle of the back are sometimes black throughout, sometimes have one pale ring and a long black tip. Lower parts, as a rule, chestnut or bay, but there is much variation as to the extent, the throat and breast being often coloured like the sides, speckled greyish, and occasionally the whole under surface is buff. In some skins the breast and a band in the middle of the chestnut belly are speckled greyish, as in the *S. gordonii* form of *S. erythræus*. Tail, as a rule, subannulate, the hairs being alternately ringed with isabelline and black, about 4 rings of each, but at times there are long pale or rufous tips to the hairs, and in some skins the hairs are chiefly or entirely rufous white, in others black with rufous tips. Vibrissæ white, white mixed with black, or black.

Dimensions. Head and body 8·5 inches, tail without hair 7·4, with hair 10, hind foot without claws 1·8; extreme length of skull 1·95, basal length 1·7, zygomatic breadth 1·2.

Distribution. Northern Tenasserim, from considerably north of Moulmein to Tavoy. Common in Amherst. Not known certainly to occur further south. Some specimens have been procured in Lower Pegu.

Varieties. The excessive variability of this form in colour will be seen from the description. The pale lower surface in some skins may be due to immaturity, but the presence or absence of a

black patch on the back does not appear to be connected with age, sex, or season, so far as is known. Moulmein specimens appear always to have white vibrissæ; a large collection of skins from Myawadi, 65 miles north of Moulmein, have black vibrissæ, but all the latter have black backs. *S. hyperythrus* of Blyth is a very rufous variety without either black dorsal patch or white whiskers.

Habits. Tickell in his MS. notes states that this squirrel is more common in bushes and hedges near villages, clumps of bamboos and thickets, than in high forest. It has a low cackling cry, and makes a grunting noise when alarmed.

253. *Sciurus palmarum.* *The Palm-Squirrel,*
or common striped Squirrel.

Sciurus palmarum, *L. Syst. Nat.* i, p. 86 (1766); *Elliot, Mad. Jour.* L. S. x, p. 216; *Blyth, J. A. S. B.* xvi, p. 874; *id. Cat.* p. 106; *Jerdon, Mam.* p. 170; *Anderson, An. Zool. Res.* p. 257.

Sciurus penicillatus, *Leach, Zool. Misc.* i, p. 6, pl. i (1814); *Horsfield, Cat.* p. 152.

Funambulus indicus, *Lesson, Illust. Zool.* pl. xlii (1832).

Sciurus brodei, *Blyth, J. A. S. B.* xviii, p. 602, xx, p. 166, xxi, p. 350; *Kelaart, Prod.* p. 53.

Sciurus kelaarti, *Layard, Blyth, J. A. S. B.* xx, p. 166; *id. A. M. N. H.* (2) ix, p. 336 (1852); *Kelaart, Prod.* p. 53.

Gilehri, II.; *Berül, Lakhi*, Beng.; *Tidra, Tu*, Kol.; *Khadi*, Mahr.; *Alalu*, Can.; *Urtu, Wadar, Vodata*, Tel.; *Chitta Anathan*, Tam.; *Lena*, Cingalese.

Ears covered with short hair. Tail with long hair throughout. Fur short. Naked sole of hind foot not extending quite to heel. Outer posterior pad of hind foot broadly oval, anterior to end of long inner pad. Two pairs of mammæ, ventral and inguinal.

Colour of back finely speckled brown, varying from greyish or rufescent to almost black, with three well-marked whitish isabelline or pale rufescent longitudinal stripes from the back of the neck to the rump, the middle stripe extending sometimes on to the base of the tail. All three stripes are about $\frac{1}{3}$ to $\frac{1}{4}$ inch broad and subequal. Dark dorsal hairs black, with usually one pale rufous or isabelline subterminal ring. Head paler than back. Sides paler than back and frequently similar in colour to the pale dorsal stripes; the lateral border of the dark dorsal area sharply defined, so that the back may be considered as bearing 4 broad dark longitudinal bands, the two outer narrower than the two inner. Lower parts white, whitish or grey, the hair dusky at the base. Tail blackish or hoary, the hairs either whitish or rufous with two black rings, the more distal generally much the longer; tips of hair always whitish.

Dimensions. Head and body 5.5 to 6 inches, tail with hair rather more, hind foot 1.5; basal length of skull 1.35, extreme length 1.55, zygomatic breadth 0.9.

Distribution. Common throughout India and Ceylon in the more open and cultivated parts, especially near human habitations. Not found on the Malabar coast, nor east of the Bay of Bengal, nor in forest. To the west this squirrel extends into Sind and Baluchistan, though rare in both.

Habits. This is one of the commonest and best known animals of India, and of all wild mammals, in great part from its diurnal habits, it is perhaps the most familiar. It is commonly found in groves and gardens, and in avenues of trees along roads, especially on large

feeding on the ground above, and it takes refuge in the branches when alarmed. It also very commonly inhabits the rafters and thatch of houses and enters rooms freely. From its abundance about cultivation and houses and from its not being found in forests, this species is probably a follower or "commensal" of the human race, as *Mus rattus*, *M. decumanus*, and *M. musculus* certainly are; and *S. palmarum* may be the semi-domesticated form of *S. tristriatus*, just as Mr. Dobson has suggested that *Crocidura cerulea* is of *C. murina*.

The food, as with other squirrels, consists of seeds, fruits, buds, &c., and according to McMaster of insects also. I have, I think, seen this species eat the flying termites or white-ants. McMaster says *S. palmarum* is said to destroy birds' eggs; but this he doubts, on the very reasonable ground that a nest robber would in the breeding-season cause much excitement among the small birds with which the squirrel lives on perfectly friendly terms. However, as Sterndale justly remarks, *S. vulgaris* is commonly accused of the same propensity in Europe. The cry of the palm-squirrel is a shrill chirp, resembling the note of a bird. The little animal is very easily tamed, having originally little or no fear of man.

The female has, according to Jerdon, two to four young at a birth. It constructs a rough bulky nest, of grass, wool and any fibrous matter it can obtain, in the branches of trees, or sometimes in the eaves or rafters of houses.

Blyth and Jerdon classed the small rufous striped squirrels, *S. brodei* and *S. kelaarti*, as varieties of the next species, which they thought replaced *S. palmarum* in Ceylon; but unless these small broad-striped forms from Ceylon, of which there are many specimens in the British Museum, are classed with *S. palmarum*, it is impossible to keep *S. tristriatus* distinct. Some of the Indian varieties with dark back and the tails rufous beneath, referred by various writers to *S. tristriatus*, must also be united to *S. palmarum*, if the two are kept separate.

254. *Sciurus tristriatus*. The jungle striped Squirrel.

Sciurus tristriatus, Waterhouse, Charlesworth's Mag. Nat. Hist. i, p. 499 (1837); *id.* P. Z. S. 1839, p. 118; Blyth, J. A. S. B. xvi, pp. 874, 1001, xviii, p. 601; *id.* Cat. p. 106; Kelaart, Prod. p. 51; Jerdon, Mam. p. 171; Anderson, An. Zool. Res. 258.

Sciurus (Tamias) *dussumieri*, A. Milne-Edwards, Rev. Mag. Zool. xix, p. 226 (1867).

Anan, Mal. Other Indian names same as those of the last species.

Structure as in the last except that the skull is broader in pro-

portion and the nose more produced. Colour very similar but darker; the back is black or blackish brown, with three narrow longitudinal white or whitish subequal stripes, not more in general than $\frac{1}{8}$ inch in width, and usually not extending so far back as the root of the tail. Head rufous above, sides greyish brown, belly whitish or grey; tail-hairs deep rufous, with black rings and a white tip.

Dimensions. Head and body 7·5 inches, tail without hair 6·25, with hair 7·5; basal length of skull 1·6, extreme length 1·8, zygomatic breadth 1.

Distribution. Throughout a great part of the peninsula of India and Ceylon, in forest regions. Anderson records this species also from Sikhim. Common in Malabar.

Habits. The voice is said by both Blyth and Jerdon to be quite different in character from that of *S. palmarum* and much less shrill. Although generally a denizen of the woods, this species has been known to enter and inhabit houses in places where the palm-squirrel does not occur, and a case is mentioned by Jerdon as occurring in his own house at Tellichery.

I feel much doubt as to the distinctness of this form from *S. palmarum*, which I suspect, as mentioned under that species, to be a semi-domesticated variety.

255. *Sciurus layardi*. *Layard's striped Squirrel*.

Sciurus layardi, *Blyth, J. A. S. B.* xviii, p. 602; *id. Cat.* p. 107; *Kelaart, Prod.* p. 53; *Layard, A. M. N. H.* (2), ix (1852), p. 335; *Jerdon, Mam.* p. 172; *Anderson, An. Zool. Res.* p. 260.

Colour above dark brown, faintly speckled; back blackish with three longitudinal pale bands, that in the middle orange or buff-coloured, well marked, running the whole length of the back, the lateral bands brownish, fainter and shorter. Dorsal hair black, with one small orange ring near the tip. Lower parts deep rusty red, hairs dusky at the base. Tail hoary above, ferruginous below. Basal half of caudal hair rather more rufous with one narrow black ring, terminal half black with whitish tips.

Dimensions. About the same as *S. tristriatus* or rather larger.

Distribution. The mountainous parts of Ceylon, and also, according to Jerdon, of Travancore.

Habits. A forest animal, like *S. tristriatus*, of which this may prove to be a variety.

256. *Sciurus sublineatus*. *The dusky striped Squirrel*.

Sciurus sublineatus, *Waterhouse, P. Z. S.* 1838, p. 19; *Blyth, J. A. S. B.* xvi, p. 875; *id. Cat.* p. 107; *Jerdon, Mam.* p. 173; *Anderson, An. Zool. Res.* p. 260.

Sciurus delesserti, *Gervais, Mag. Zool.* 1842, pl. 31.

Sciurus trilineatus, *Waterhouse, Blyth, J. A. S. B.* xx, p. 165 (1851); *Kelaart, Prod.* p. 54.

Size small. Naked sole of hind foot not extending quite to heel; outer posterior pad of hind foot oval, short, more distal in position than the long linear inner pad. Fur soft and dense.

Colour. Upper parts dull brown, finely speckled; middle of back deeper brown, with three indistinct narrow pale lines, closer together and shorter than in *S. palmarum* and its allies, and only extending in general from behind the shoulder to the loins. Dorsal hair leaden black at the base, then jet-black; with one or two whitish or orange rings. Lower parts pale brown, more or less rufescent, or dull grey. Tail-hairs with alternating orange or whitish and black rings of subequal length, 3 or 4 of each colour.

Dimensions. Head and body 5 inches, tail with hair rather more, hind foot 1·2; zygomatic breadth of skull 0·7.

Distribution. The mountains of Southern India, Wynaad, Nilgiri, Palni, Travancore &c., and Ceylon. Found as far north as Coorg. Not recorded from the Shevaroyes. According to Kelaart this squirrel is not found in Ceylon below 3000 ft. elevation.

This also is a forest animal, but, despite its stripes, has probably but little affinity with *S. palmarum* and its allies.

257. *Sciurus maclellandi*. *The striped Himalayan Squirrel.*

Sciurus maclellandi, Horsfield, *P. Z. S.* 1839, p. 152; Blyth, *J. A. S. B.* xvi, p. 875; *id. Cat.* p. 107; Jerdon, *Mam.* p. 173;

Anderson, *An. Zool. Res.* p. 203; Thomas, *P. Z. S.* 1886, pp. 61, 71.

Sciurus pembertonii, Blyth, *J. A. S. B.* xi, p. 887.

Sciurus barbei, Blyth, *J. A. S. B.* xvi, p. 875, pl. xxxvi, f. 3 (1847);

id. Cat. p. 107; *id. Mam. Birds Burma*, p. 38; Blanford,

J. A. S. B. xl'ii, pt. 2, p. 164.

Sciurus maclellandi, var. *swinhoei*, M.-Edw. *Rech. Mam.* p. 308.

Ears covered outside with long hair forming a pencil. Tail with long hair below, but less bushy than in most squirrels. Three pairs of mammae, ventral and inguinal, the anterior pair nearer to the axil than to the groin.

Colour of upper parts dull greyish brown lighter or darker; a well-marked black stripe down the middle of the back with a pale band, ill-marked in Northern specimens, on each side; outside this again is a broad dark band, brown in Himalayan specimens, black in Tenasserim; again outside this is a broad pale buff or whitish band extending from the muzzle down each side of the head, neck, and body, and in some Tenasserim skins this pale band has an outer black border. Dorsal hairs black at the base. Hair on outside of ears black, the hairs on the tips of the ears with long white terminations. Lower parts varying from whitish or pale brown to buff or pale rufous or dull grey. Tail with alternating rufous, whitish, and black rings, usually rufous at the base, then black, then rufous, then a long subterminal black space and a whitish tip.

Dimensions. Head and body 4·5 to 5 inches, tail without hair 3·75 to 5, with hair 5 to 6, hind foot from heel 1·1. Weight about 2·5 oz. A Sikhim skull measures in extreme length 1·35, basal length 1·1, zygomatic breadth 0·3.

Distribution. Found in Sikhim and the Eastern Himalayas, extending eastward into China and as far as Formosa, also in the Assam hills, Cachar and Manipur, throughout the Tenasserim provinces and the Malay peninsula (I possess a specimen collected by Mr. Davison and labelled Malacca), and in Siam and Cochin China. I cannot find this species recorded from Arrakan or Pegu, nor was it obtained by Hodgson at Katmandu in Nepal. All his specimens apparently were from Darjiling.

Varieties. Two very distinct races occur within our area:—

1. Typical *S. maccllellandi*, from the Eastern Himalayas, has but one black line on the back, in the middle, and only two distinct pale stripes, one on each side.
2. *S. barbei*, from Tenasserim, is altogether more brightly coloured and has four distinct buff stripes on the back, two on each side, and either 3 or 5 black stripes. Skins from Manipur are intermediate between the two races, and Chinese specimens (*S. maccllellandi*, var. *swinhoei*) are duller in colour than Himalayan.

Habits. This squirrel is found in high forest, and, so far as is known, but rarely descends to the ground.

258. *Sciurus berdmorei*. *Berdmore's Squirrel*.

Sciurus berdmorei, *Blyth, J. A. S. B.* xviii, p. 603 (1849), xxviii, p. 418; *id.* *Cat.* p. 106; *id.* *Man. Birds Burma*, p. 37; *Anderson, An. Zool. Res.* p. 261; *Thomas, P. Z. S.* 1886, p. 71; *Anderson, Fauna Mergui Arch.* i, p. 340.

Sciurus mouhoti, *Gray, P. Z. S.* 1861, p. 137; *Blanford, J. A. S. B.* xlvii, pt. 2, p. 162.

Muzzle long and narrow. Ears well clad. Tail with long hair beneath. Soles of the hind feet bare to the heel, and smooth, not tuberculated; the outer posterior pad is linear, but anterior in position to the long inner posterior pad. Three pairs of mammae, ventral and inguinal.

Colour above brown, finely speckled, rufescent on the back, yellower or greyer on the sides. There are two pale yellowish or whitish longitudinal bands on each side; the upper narrower and better defined than the lower. Between the two and above the upper pale band, the fur is darker as a rule and sometimes blackish, and occasionally there is a short black band in the middle of the back. Dorsal fur dusky at the base, then alternately orange and black, usually two rings of each, the tip black. Lower parts white, sometimes tinged with buff. Tail blackish, rendered hoary by the white tips, sometimes indistinctly annulated; hairs light brown or rufous at the base, then black, then rufous again, then for a considerable length black, to near the tips which are whitish.

Dimensions. Head and body 7 inches, tail without hair 5.5, with hair 7.5, hind foot 1.5; extreme length of skull 2.

Distribution. Martaban and Tenasserim, Mergui Archipelago, Cambodia and Cochin China.

Habits. This is said to be chiefly a ground squirrel, and Blyth doubts if it ever ascends trees. Probably, however, its habits are not unlike those of *S. palmarum*. It is said to be found about cultivation.

Subfamily ARCTOMYINÆ.

The marmots, of which this subfamily is composed, are Palearctic and Nearctic, and comprise three genera, *Arctomys*, *Spermophilus*, and *Cynomys*. Only the first of these, distinguished from the others by the want of cheek-pouches, is represented in the Himalayas within our limits. All the members of this subfamily are burrowers, and live in holes in the ground. Some inhabit mountains, others open plains.

Genus ARCTOMYS, Schreber (1792).

Form stout, tail short or moderate, ears very small. Thumb rudimentary.

Dentition: i. $\frac{2}{2}$, pm. $\frac{2-2}{1-1}$, m. $\frac{-3}{3-}$, as in *Sciurus*. Incisors not compressed. Anterior upper premolar larger than in squirrels, but still much smaller than the second; molars broad.

Synopsis of Indian Species.

Tail less than $\frac{1}{3}$ head and body; colour greyish. *A. himalayanus*, p. 388.

Tail about $\frac{1}{3}$ head and body; colour greyish .. *A. hodgsoni*, p. 389.

Tail fully $\frac{1}{2}$ head and body; colour yellow .. *A. caudatus*, p. 390.

259. *Arctomys himalayanus*. *The Tibet Marmot*.

Arctomys himalayanus, *Hodgson, J. A. S. B.* x, p. 777, plate (1841), xi, p. 287; ("*potius tibetensis hodie*") xii, p. 409; *Blanford, J. A. S. B.* xliv, pt. 2, p. 121; *id. Yarkand Miss., Mam.* p. 36, pls. xii, xii a; *Lydekker, J. A. S. B.* xlix, pt. 2, p. 7; *Büchner, Przewalski Reis., Säugeth.* p. 25.

Arctomys bobac, *Gray, List Mam. B. M.* 1843, p. 148, partim; *Blyth, Cat.* p. 108, partim; *Jerdon, Mam.* p. 181, partim; *Stoliczka, J. A. S. B.* xxxiv, p. 111; *Anderson, P. Z. S.* 1871, p. 560.

Arctomys tibetanus, *Adams, P. Z. S.* 1858, p. 521.

Brin, Kashmir; *Pfff*, Niti; *Kadia-piu*, *Phya*, Tibetan; *Chibi*, Bhotia of Sikkim.

Tail about $\frac{1}{4}$ the length of the head and body. Six pairs of mammæ, extending from the axil to the groin.

Colour of body and limbs pale tawny, much mixed with black on the upper parts; basal half of fur (basal third on belly) dark brown, terminal half pale fulvous, with black tips on the upper parts; face and terminal third of tail dark brown; cheeks sometimes rufescent.

Dimensions. Head and body 22 to 24 inches, tail without hair 5 to 5·5, with hair 6 to 6·5, hind foot 3·25; basal length of skull 3·85, extreme length 4·1, zygomatic breadth 2·6.

Distribution. Tibet north of the main Himalayan chain, from the neighbourhood of Lhasa to Ladák and the Kuenlun. Common in Bukshu and Ladák at elevations of from about 13,000 or 14,000 feet to 18,000. This species was also obtained in Northern Tibet by Przewalski.

Habits. This marmot inhabits the bleak dry plateau of Tibet in colonies, its burrows being most commonly found on the sides of valleys. It lives on roots and vegetables, coming out to feed in the morning and evening; it doubtless hibernates in the winter. The alarm cry is "a short chirping bark" according to Lydekker. Marmots are easily tamed, and the present species is no exception.

260. *Arctomys hodgsoni*. *The smaller Himalayan Marmot.*

Arctomys hemachalanus, Hodgson, *J. A. S. B.* xii, p. 410 (1843); *Jerdon, Mam.* p. 182; *Blanford, J. A. S. B.* xlv, pt. 2, p. 122; *nec A. himalayanus*, Hodgson.

Arctomys tibetanus, Gray, *Cat. Mam. &c. Nepal & Tibet*, 1846, p. 24; *id.* 2nd ed. p. 12; *nec A. tibetensis*, Hodgson.

Arctomys bobac, Blyth, *J. A. S. B.* xvi, p. 875, partim; *id. Cat.* p. 108, partim, *nec Schreber*.

Arctomys hodgsoni, W. Blanford, *Yarkand Miss., Mam.* p. 35; *id. P. Z. S.* 1880, p. 453.

Jabra, Bhotia.

Tail about a third as long as the body and head. Five or six pairs of mammae.

Colour almost identical with that of *A. himalayanus*, tawny, the dorsal fur dusky at the base and black-tipped, bridge of nose and end of tail dark brown. Sides of head, ears, and limbs rufous, especially in summer.

Dimensions. Head and body 12 to 13 inches, tail 5½, hind foot nearly 3. I believe these measurements, which are Hodgson's, are too small, and that the species grows to 16 or 18 inches from nose to vent. An adult skull measures 3·7 in extreme length, 2·4 in zygomatic breadth.

Distribution. Nepal, Sikhim, and Bhutan; probably Cis-Himalayan, whilst *A. himalayanus* is Trans-Himalayan.

Nothing is known of this species except in confinement. I have never seen the skin of a wild specimen, nor, I believe, has one been recorded, although there are, at present, no less than fifteen specimens in the Indian Museum, Calcutta, and this marmot is apparently far from rare in Sikhim. Hodgson had both this and *A. himalayanus* in confinement. The name *hemachalanus*, being identical with *himalayanus*, cannot be employed.

261. *Arctomys caudatus*. *The red or long-tailed Marmot.*

Arctomys caudatus, Jacquemont, *Voyage dans l'Inde*, iv, p. 66; *Atlas*, ii, pl. 5 (1844); *Blanford*, *J. A. S. B.* xliv, pt. 2, p. 122; *id.* *Yarkand Miss.*, *Mam.* p. 37, pls. xiii, xiii a; *Lydekker*, *J. A. S. B.* xlix, pt. 2, p. 7; *Scully*, *P. Z. S.* 1881, p. 204; *id.* *A. M. N. H.* (5) viii, p. 98.

Arctomys bobac, *Adams*, *P. Z. S.* 1858, p. 521; *Blyth*, *Cat.* p. 108, *partim*, *nec Schreber*.

Arctomys hemachalanus, *Anderson*, *P. Z. S.* 1871, p. 561, *nec Hodgson*.

Drun, Kashmir.

Tail about half the length of the head and body.

Colour yellowish tawny to orange, the back chiefly black, sometimes wholly black, in the middle, the hairs being black throughout; usually the dorsal fur is blackish at the base, then tawny and with long black tips. Face brown, blackish round the eye; tail black at the tip and usually for a considerable portion of the length, tawny towards the base. Lower parts and limbs brownish rufous, deeper in some examples than in others. The general tint is more rufous than in the other Himalayan species and the back is blacker.

Dimensions. Head and body about 2 feet, tail with hair 12 to 13 inches, hind foot 3·4; basal length of skull 4·1, extreme length 4·2, zygomatic breadth 2·6. Specimens from Astor appear smaller.

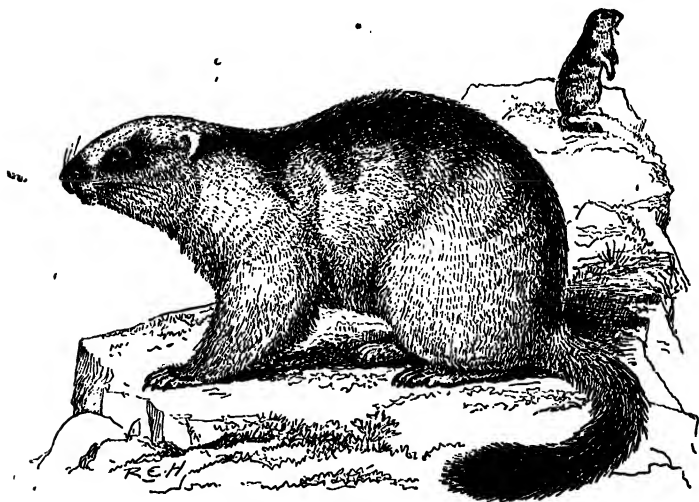


Fig. 124.—*Arctomys caudatus*.

Distribution. The ranges immediately north of Kashmir proper from Wardan to Deosai and Astor, at elevations between 8000 and 14,000 feet. I can find no account of this marmot's occurrence east of Kashmir, nor is it found in Ladák except on the southern border.

Habits. Similar to those of *A. himalayanus* and other marmots. The call, however, is different; Adams describes it as a loud wailing cry, Lydekker as a long screaming whistle of great shrillness. *A. caudatus* inhabits comparatively fertile localities on the border of the dry region, and is found at a lower elevation than *A. himalayanus*.

Other Central-Asiatic species of marmot are *A. dichrous* from Northern Afghanistan, *A. aureus* from the mountains west of Yarkand, both allied to *A. caudatus* but smaller, and *A. robustus* from Eastern and North-eastern Tibet, allied to *A. himalayanus* but classed as distinct by Milne-Edwards and Büchner. A *Spermophilus*, *S. bactrianus*, has recently been described by Dr. Scully from Afghan Turkestan.

Family DIPODIDÆ.

The present subdivision is composed of the Asiatic and African jerboas, the North-American jumping mice (*Jaculus*), the Cape jumping hare (*Pedetes*), and a few other forms. As a rule they are distinguished by hind limbs of disproportionate length, and a long hairy tail, and both in their form and mode of progression resemble kangaroos. They not only move quickly by jumping on their hind legs, but are said to use their tails to aid their movements.

The molars have transverse enamel-folds, the incisors are compressed. The brain-case is short and broad, the infraorbital opening rounded and very large, the zygomatic arch slender and curved downwards, the malar ascending in front of the orbit to the lacrymal in a flattened perpendicular plate, the mastoid (supratympanic) part of the bulla generally greatly developed. The elongated metatarsals are united to form a cannon bone. Hind feet with but three functional digits. Cervical vertebræ more or less ankylosed.

A single species just enters the margin of the Indian area from Central Asia.

Genus *ALACTAGA*, F. Cuv. (1836).

Syn. *Scirtetes*, Wagner.

On the hind foot there are 5 toes, the first and fifth not reaching the ground. Tail long, cylindrical, tufted at the end. Ears long.

Dentition: i. $\frac{3}{0}$, pm. $\frac{1-1}{0-0}$, m. $\frac{3-3}{3-3}$. Incisors not grooved; premolars small, sometimes lost, two anterior molars in both jaws much larger than the third, and bearing external and internal enamel-folds that become loops with wear.

262. *Alactaga indica*. *The Afghan Jerboa*.

Alactaga indica, Gray, *A. M. N. H.* x, p. 262 (1842); *Hutton*, *J. A. S. B.* xv, p. 137; *Blanford*, *Eastern Persia*, ii, p. 77; *Sclater*, *P. Z. S.* 1880, p. 538.

Alactaga bactriana, *Blyth*, *Cat.* p. 110.

Khani, in Afghanistan.

The first and fifth toes of the hind foot are subequal, about 0·8 inch short of the middle toe, second and fourth toes 0·15 short. Toe-pads transversely grooved. Ears very long, exceeding the fore leg in length. Fur soft. Tail twice the length of the head and body.

Colour above fawn or light rufescent brown, sometimes mixed with black, becoming paler and more rufous on the sides; lower parts white, and a white band across the outside of each thigh, a black spot sometimes behind and inside the thigh just below the white band. Basal two-thirds or more of hair on the back ashy, light or dark, tips of hairs sometimes black. Tail light brown, the tuft of long hair at the end blackish brown except the tip, which is white.

Dimensions of a male: head and body 3·6 inches, tail without terminal hair 7, with terminal tuft 7·6, ear from crown of head 1·7, hind foot and tarsus 2·2; basal length of skull 1, zygomatic breadth 0·85.

Distribution. Afghanistan, South-eastern Persia, and Northern Baluchistan. Not uncommon on the plains south of Quetta at an elevation of about 6000 feet.

Habits. According to Hutton this jerboa is abundant in the stony plains of Afghanistan, burrowing deeply. When unearthed it bounds away with surprising agility on its hind legs. It is thoroughly nocturnal, sleeping soundly all day. It retires to its burrow in October and remains dormant till the following April. It is easily tamed. Major Money, who sent a living specimen to the Zoological Gardens, London, observed that this jerboa appeared not to require water in its natural state, though it drank in captivity. It fed on green wheat, rice, lucerne or maize, raw potatoes, gram or other grain, and dry biscuit.

The name given to this jerboa by Gray is very objectionable, as the species cannot be said to occur in India. Blyth's name *bactriana* is scarcely better. From the nearly allied *A. acoution*, Pallas, the present species is distinguished by its proportionally longer ears and tail.

Several other species of *Alactaga* and of *Dipus*, the latter having grooved incisors and only three toes on each hind foot, occur in Central Asia.

Family MURIDÆ.

This large and cosmopolitan family comprises the mice and rats, with a large number of allied forms. The following are the principal characters:—

Skull without postorbital processes. Infraorbital opening large, almost always wide above, and terminating below in a narrow groove, the outer wall of which is always a flattened plate, forming the lower root of the maxillary zygomatic process. Malar short and slender. Premolars none; dentition in all Indian genera i. $\frac{2}{2}$, m. $\frac{3-3}{3-3}$.

The number of subfamilies into which this family was divided by Peters and Alston (P. Z. S. 1876, pp. 69, 80), who have been followed by several writers, appears to me too large, and I cannot agree in placing *Nesocia*, which is barely distinguishable generically from *Mus*, in a distinct subfamily from the latter. At the same time, the classification of this extensive family is very difficult. The Indian forms may be thus classed, but the distinctive characters do not always apply to genera not found in India:—

- A. Tail much more than $\frac{1}{3}$ total length, generally $\frac{1}{2}$ or more.
 - a. Crowns of worn molars with oblique subparallel bands of enamel; tail with long coarse hair. *Platacanthomyiinae*.
 - b. Crowns of worn molars with transverse laminæ forming oval or lozenge-shaped patterns; tail hairy; hind legs elongate *Gerbillinae*
 - c. Crowns of upper molars with 3 longitudinal rows of tubercles, lower with 2 rows (except in *Hapalomys*); worn molars with transverse enamel-bands curved or straight; tail naked, or thinly clad, scaly *Murinae*.
- B. Tail (in all Indian forms) less than $\frac{1}{3}$ total length; all molars either with tubercles in 2 longitudinal rows, or composed of subtrigonal prisms similarly arranged. *Cricetinae*.

As with other small mammals, the measurements are chiefly from specimens preserved in alcohol, and in these, especially if strong spirit has been used, the body contracts in length rather more than the tail, whilst membranous parts, such as the ears, shrink rather more in proportion than the body.

MURIDÆ.

Subfamily PLATACANTHOMYINÆ.

Molars rooted, subequal in size, crossed by subparallel folds of enamel directed obliquely inwards and backwards. Anterior palatine foramina small, not extending back beyond the hinder margin of the premaxillaries. Auditory bullæ small. Coronoid process of mandible short. Tail long, hairy.

Genus PLATACANTHOMYS, Blyth (1859).



Fig. 125.—Crowns of (a) upper and (b) lower right molars of *P. lasiurus*, $\times 4$.

Form resembling that of a dormouse. Tail clad with long coarse straight hairs, arranged distichously towards the tip. Pollex and hallux short, clawless (the latter may sometimes bear a nail). Skull broad, flattened above behind; a well-marked supraorbital ridge on each side. Infraorbital foramen very large. Bony palate broad, imperfect, perforate. Incisors smooth, narrow.

A single known species peculiar to the hills near the Malabar coast.

263. *Platacanthomys lasiurus*. *The Malabar spiny Mouse*.

Platacanthomys lasiurus, Blyth, *J. A. S. B.* xxviii, p. 288 (1859); *Id.* *Cat.* p. 109; Peters, *P. Z. S.* 1865, p. 398, pl. xx; Jerdon, *Mam. Ind.* p. 210.

Ears large, pointed, posterior margin slightly concave below the tip. Vibrissæ numerous, several of them more than twice the length of the head. Fur of the upper parts mixed with broad flat spines having thickened edges. Tail hairy throughout, the hair coarse but not spiny, and subdistichous, short near the body and gradually increasing in length towards the tip of the tail. Five pads on each palma, and 7 or 8 on the planta, including one long inner metatarsal pad and two or three outer, behind each other, all but the first small. Claws overhung by hair. Mammaræ one pair pectoral and one inguinal (Blyth gives 2 pairs abdominal).

Colour above reddish brown, below nearly white, the colours not passing into each other; dorsal fur white at the base and for three quarters of its length or more, tips above brown. Feet white or whitish. Tail coloured like the back above and below, the extremity sometimes whitish.

Dimensions of an adult in spirit: head and body 4·5 inches, tail without hair 3·8, with hair 5, hind foot from heel 0·95, ear 0·8. Basal length of skull 1·05, extreme length 1·25, zygomatic breadth 0·7.



Fig. 126.—*Platacanthomys lasiurus*.

Distribution. Anaimalai and Travancore hills at elevations of more than 2000 feet above the sea. There is a specimen in the British Museum labelled Ootacamund, but I feel doubtful if the locality is correct. The species has not been recorded from Ceylon.

Habits. The Rev. H. Baker, who discovered *Platacanthomys*, informed Mr. Blyth that the species lived exclusively in large trees, in which these rats hollowed out little cavities that they filled with leaves and moss. They were said by the hill-people to destroy much pepper and to do serious damage to angely and jack fruit (*Artocarpus incisa* and *A. integrifolia*), also to be fond of fermented palm-juice or toddy.

Subfamily GERBILLINÆ.

Molars rooted, tubercular at first; when they are worn, the enamel forms transverse oval or lozenge-shaped patterns that after a time coalesce in the middle of the tooth. Auditory bullæ large. Hind limbs elongate; tail hairy.

This subfamily is found in Asia and Africa. A single genus is Indian.

Genus GERBILLUS, Desmarest (1804).

Syn. *Meriones*, Illiger (1811).

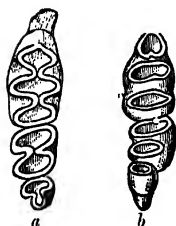


Fig. 127.—(a) Upper and (b) lower right molars of *G. indicus*, $\times 3$.

Tail long, hairy, with a terminal pencil of long hair. Head slightly elongate, ears moderate. Mammary 4 pairs: 2 pectoral, 2 inguinal. Large metacarpal pads.

Dentition: i. $\frac{2}{3}$, m. $\frac{3-3}{3-3}$. Upper incisors grooved longitudinally, anterior molar in both jaws composed of three transverse elliptical or lozenge-shaped areas, the second of two, and the third of one; the posterior upper molars with a more or less rudimentary second ridge or heel, soon disappearing with wear. Occipital region of the skull broad.

Synopsis of Indian and Ceylonese Species.

- | | |
|--|-------------------------------|
| A. Size of a rat. Snout to vent exceeding 4 in. | |
| a. Planta entirely naked | <i>G. indicus</i> , p. 396. |
| b. Distal half of planta hairy; ear 0.25 in. | <i>G. hurriane</i> , p. 398. |
| c. Whole planta hairy; ear 0.45 in. | <i>G. erythrura</i> , p. 399. |
| B. Size of a mouse. Snout to vent less than 3.5 in. | |
| a. Planta with 6 pads, proximal half naked .. | <i>G. nanus</i> , p. 399. |
| b. Planta without distinct pads, hairy throughout..... | <i>G. gleadowi</i> , p. 400. |

264. *Gerbillus indicus*. The Indian Gerbille or Antelope Rat.

Dipus indicus, Hardwicke, Linn. Trans. viii, p. 270, pl. vii (1807).
Gerbillus indicus, F. Cuv. Tr. Z. S. ii, p. 143, pl. xxv, figs. 15-19;
 Blyth, J. A. S. B. xxxii, p. 327; *id.* Cat. p. 110; Jerdon, Mam.
 p. 184; Blanford, Eastern Persia, p. 63.
 Mus (*Gerbillus*) *indicus*, Elliot, Mad. Journ. L. S. x, p. 211.
Gerbillus cuvieri and *G. indicus*, Waterhouse, P. Z. S. 1838, p. 56.
Gerbillus cuvieri, Hutton, J. A. S. B. xv, p. 139.

Harna mûs (antelope rat), H.; *Jhenku indûr*, Beng.; *Pândhard undîr*, Mahr.; *Yeri yelka*, Wadârî; *Tel yelka*, Yenadi; *Billa ilei*, Canarese.

Tail longer than head and body. Ears moderate, rounded, thinly clad. Planta naked, distal portion granular. Two pads at

base of three middle toes, one inside the base of first and another inside the base of fifth toe, four in all. Eyes very large.



Fig. 128.—*Gerbillus indicus*.

Colour light brownish rufous, varying from sandy brown to fawn-colour above; lower parts white, the colours sharply divided at times (probably in summer fur only). Basal two-thirds or more of dorsal hair leaden grey, a few longer hairs on the back, especially towards the rump, with long black tips. Area above and behind the eye, a spot behind the ear, and the whole upper lip white. Tail with a light brown band down each side, above and below darker, the upper surface becoming blackish and clothed with longer hairs towards the end, which is tipped with a pencil of long dark hairs almost black. Feet whitish above. Planta pale or dusky.

Dimensions. Head and body 5 to 7 inches, tail 6 to $8\frac{1}{2}$, hind foot 1.3 to 1.7, ear from head 0.55 to 0.7; weight about 6 ounces. Basal length of a skull 1.65, extreme length 1.85, zygomatic breadth 1.

Distribution. Throughout India and Ceylon in suitable localities, extending west into Baluchistan, but not east of the Bay of Bengal.

Varieties. The Southern Indian form, *G. cuvieri*, is more slender, with longer tail and limbs, the planta dusky, and the first hind toe more proximally situated. Some specimens from Northern India are, however, similar, and there appears to be a complete gradation into the stouter typical *G. indicus*, which is found throughout Northern India, Sind, Baluchistan, &c. In a typical

male Madras specimen (*G. cuvieri*) the head and body measure 6.1 inches, tail 8.15, ear 0.7, hind foot 1.7; and in a Baluchistan male the corresponding dimensions are 5.9, 6.6, 0.7, and 1.4.

Habits. These have been described by Hardwicke, Elliot, and Jerdon. The Indian gerbille is thoroughly nocturnal and very rarely seen outside its hole by daylight. It inhabits uncultivated plains and sandy downs, very often on the borders of cultivation. Here it makes extensive burrows with numerous entrances, and large central chambers from half a foot to a foot in length, containing a bed of dried grass.

These rats feed upon roots and grass, especially *harayāli* (*Cynodon dactylon*), seeds and grain, and sometimes cause great damage to the crops. In 1878-79 they ravaged the grain-fields in the Deccan throughout several thousand square miles (Fairbank, J. A. S. B. xlviii, pt. 2, p. 143), cutting down jawāri (*Holcus sorghum*) and būjri (*H. spicatus*) stalks and feeding on the grain, part of which they stored in their burrows.

The Indian gerbille can make bounds of four or five yards at a time, and, as McMaster relates, often eludes dogs by its activity, sometimes jumping over their backs. The female has 8 to 12 young at a birth, occasionally, it is said, even more.

265. *Gerbillus hurrianæ*. The Indian desert Gerbille.

Gerbillus indicus, Hutton, J. A. S. B. xv, p. 137, nec Hardwicke.

Gerbillus erythrourus, Jerdon, Mam. p. 185, App. p. iii, nec Gray.

Gerbillus hurrianæ, Jerdon, ib. p. 186; Blanford, Eastern Persia, ii, p. 68.

Tip of the nose projecting so as partly to cover the nostrils. Tail about equal to head and body. Ears small, rounded, hairy outside. Distal half of planta hairy, proximal half with a considerable naked area. Fur short. Transverse elliptical folds of anterior upper molar united in the middle at an early stage of wear. Bullæ very large. Eyes moderate.

Colour light brownish grey (sandy grey) above; sullied white below, the two colours passing into each other. Some skins are rufescent above. Basal half of dorsal fur dark brown or leaden black, tips of longer hairs, more numerous about rump, black. Tail all round nearly the same colour as the back, except towards the end, where the hairs are longer and black or dark brown. Face-markings indistinct. Feet brownish white above.

Dimensions. Head and body 5.5 to 6.75 inches, tail 5 to 6.5, with hair 5.75 to 7, ear from crown 0.25, hind foot 1. A skull measures: basal length 1.25, extreme length 1.4, zygomatic breadth 0.8.

Distribution. The dry regions of North-western India, Sind, the Punjab, and Western Rajputana, also Baluchistan and South Afghanistan up to about 4000 feet above the sea.

Habits. This gerbille abounds in sandy desert or semi-desert, and is particularly common in Sind and the Indian desert between the

Indus and Rajputana, where its holes are found everywhere, especially at the roots of bushes amongst the sand-hills. It is commonly seen out in the day, in the cold season at all events, and is by no means shy. It feeds on various seeds, especially the nuts of *Salvadora persica*, and on roots.

266. *Gerbillus erythrura*. The Afghan Gerbille.

Gerbillus erythrura, Gray, *A. M. N. H.* x, p. 266 (1842); Hutton, *J. A. S. B.* xv, p. 139; Blanford, *Eastern Persia*, i, p. 70.

Nostrils partly covered by a fleshy pad. Tail about equal to the head and body. Ears rounded, moderate, hairy outside. Planta covered with hair except a narrow band along proximal part of inner margin. Fur soft, moderately long. Transverse folds of anterior upper molar united in the middle at an early stage of wear. Bullæ very large.

Colour light sandy brown above, white below, the two passing gradually into each other on the sides. Some specimens are pale rufous above. Basal two thirds of the dorsal hair dark ashy. A few long black-tipped hairs on the lower back. Feet sullied white above. A pale band above the eye, extending to the ear. Tail more or less rufous-brown, not banded, uniformly coloured all round to near the tip, when long blackish hair comes in at first above and afterwards throughout.

Dimensions. An adult male in spirit measures: head and body 4.75 inches, tail without hair 4.75, with hair 5.5, ear from head 0.45, hind foot 1.3. A skull measures: basal length 1.35, zygomatic breadth 0.95.

Distribution. Throughout an extensive area in Afghanistan and Southern Persia, keeping to considerable elevations. I shot specimens at Mehtarzai near Quetta, where the species was obtained by Hutton.

Habits. This species, like *G. hurriana*, makes its holes at the roots of bushes or in sandy banks and mounds, generally in semi-deserted tracts, but often near habitations. The animals may be seen out feeding at all hours of the day in the cold season.

267. *Gerbillus nanus*. The little Gerbille.

Gerbillus nanus, W. Blanford, *A. M. N. H.* (4) xvi, p. 312 (1875); *id.* *Eastern Persia*, ii, p. 72, pl. v, fig. 1.

Nostrils inferior in position, partly covered by the snout. Tail long, more than one and a half times the length of the head and body. Proximal half of planta smooth, naked; distal half granular, with scattered hairs and bearing three pairs of pads. Two metacarpal pads. Vibrissæ very long. Ears oval, thinly furred.

Colour pale fawn above, white below, the two colours blending. Dorsal hairs ashy grey for basal two thirds. Tail light brown

above, becoming rather darker at the tip, but not black, white beneath, no light bands down the sides. Supercilium and sides of face in front of the eyes with most of the vibrissæ white.

Dimensions. Head and body 2·8 inches, tail without hair 4·45, with hair 4·85, hind foot 0·85, ear from orifice 0·45. A skull measures 1·05 in extreme length by 0·55 broad.

Distribution. I first procured this Gerbille west of Gwádar in Baluchistan and have since obtained it at Sukkur and at Laki near Sehván in Sind. It appears rare. A very similar, probably identical, form is found in Arabia and on the Abyssinian coast-land.

268. *Gerbillus gleadowi.* *The little hairy-footed Gerbille.*

Gerbillus gleadowi, *Murray, A. M. N. H.* (5) xvii, p. 240 (1886).

Nostrils inferior, partly covered by snout. Tail more than one and a half times the length of the head and body. Planta thinly covered with hair throughout; no distinct pads, an irregular swelling at the base of the toes. Palma swollen, hairy, with one large naked pointed metacarpal pad near the base of the rudimentary pollex. Ears well clad.

Colour rufous-fawn above, white below, the two colours well defined, basal two thirds of dorsal fur slaty. Tail almost uniform pale brownish, paler below, whitish near the tip; the terminal pencil brown above, white below. Supercilium, sides of face in front of the eyes, and all vibrissæ except the uppermost white; a rufous cheek-patch.

Dimensions. Head and body 3·25 inches, tail without hair 5, with hair 5·4, hind foot 1. Extreme length of skull 1·12, basal length 0·9, breadth 0·6.

Distribution. Rohri district, Upper Sind, is the only locality whence this Gerbille has hitherto been obtained.

Gerbillus swinhoei (Scully, *A. M. N. H.* (5) viii, p. 228, 1881) is rather larger than *G. gleadowi*, but much like that species, except that it has a very much shorter tail, the palma naked, and two metacarpal pads. Planta hairy throughout. Head and body 3·4 inches, tail without hair 3·1, with hair 3·5, hind foot 0·93. Found halfway between Kandahar and the Kojak Pass, and to be looked for around Quetta. Several species of *Gerbillus* inhabit Central and Western Asia and Africa, but none are found in Burma, the Malay Countries, or Southern China.

Subfamily MURINÆ.

Molars rooted, tubercular at first, the tubercles on the upper molars disposed in a triple row longitudinally. When worn the molars exhibit transverse laminae of enamel. Tail elongate, scaly, and in general nearly naked.

The Indian genera are thus distinguished:—

- | | |
|---|---------------|
| A. Tubercles on anterior lower molars in 3 longitudinal series..... | HAPALOMYS. |
| B. Tubercles on lower molars in 2 series. | |
| a. First and fifth digits of all feet with flat nails .. | VANDERLURIA. |
| b. Pollex and hallux only with flat nails, crowns of molars deeply grooved longitudinally | CHIROPODOMYS. |
| c. Pollex (thumb) only with a flat nail, other digits (except hallux in <i>Mus chiropus</i>) with compressed claws; crowns of molars not deeply grooved. | |
| a'. Upper incisors not grooved. | |
| a''. Dorsal fur wholly or chiefly composed of hair. | |
| a. Form slender; transverse laminae of molars considerably curved..... | MUS. |
| b. Form stout; laminae nearly or quite straight | NESOCIA. |
| b''. Back entirely covered with stout spines .. | ACOMYS. |
| b'. Upper incisors grooved longitudinally | GOZUNDA. |

Genus **HAPALOMYS**, Blyth (1859).

Hallux terminating in a broad tip bearing a flat nail. Each of the other digits (except the rudimentary pollex) swollen at the end into a lobe, which is deeply grooved longitudinally above, pitted at the anterior end of the groove, and transversely furrowed below to the end like the remainder of the digit. The claws, which are blunt and but little curved, apparently lie in the groove, especially in the fore feet, which have much shorter claws than the hind feet. In both, however, the tips of the digits project beyond the claws. Tail long, terminal portion flattened laterally. Skull with

Fig. 129.—Crowns of (a) upper and (b) lower right molars of *H. longicaudatus*, $\times 3$.

the nasals short, anterior border of zygoma-root vertical. Incisors smooth, lower incisors very broad; the two anterior molars in both jaws with tubercles arranged in 3 longitudinal series.

This genus, containing a single known species, differs from all other Muridæ in having the tubercles of the anterior lower molars triserially arranged.

269. *Hapalomys longicaudatus*. *Berdmore's Rat*.

Hapalomys longicaudatus, Blyth, *J. A. S. B.* xxviii, p. 296 (1859), xxxii, p. 363; *id.* *Cat.* p. 112; *id.* *Mam. Birds Burma*, p. 38.

Fur soft, dense and long. Tail much longer than the head and body, scaly and ringed, with short fine hair that becomes longer on the terminal third of the tail. Ears short, rounded, scantily clad with long hairs. Feet short. Foot-pads large, peculiarly marked

with irregular concentric lines; both metatarsal pads elongate, the hindmost greatly so and much curved. Mammaræ 8: 2 pairs pectoral, 2 inguinal. Vibrissæ numerous, fine, longer than the head. Colour brown above, dull white below. Dorsal fur slaty for the basal two thirds, then glistening brown with black tips and a few long hairs of very fine texture interspersed. Whiskers black, and there is a tuft of fine blackish hair anterior to the ears (Blyth).

Dimensions of a female in spirits head and body 5 inches, tail 8, ear from crown 0.25, hind foot 1.1; length of skull 1.4, breadth 0.8.

Distribution. Discovered by Major Berdmore at Schwe Gyeng, on the Sittoung River, Burma, in 1859. There is also in the Indian Museum, Calcutta, a specimen from Tavoy.

The terminal fourth of the tail is distinctly compressed laterally in the type specimen. Further specimens are required to show whether this is an individual character.

Genus VANDELEURIA, Gray (1842).

First and fifth toes on all feet partially opposable and furnished with a flat nail, not a claw. Claws on the remaining digits small. Hind foot long, plantar pads large; proximal metatarsal pad very elongate, quite as near to the heel as to the base of the middle toe. Tail very long, but without lengthened hair. Skull short, anterior palatine foramina moderate, anterior border of zygoma-root vertical, not emarginate above. Molars broad, transverse bands of enamel deeply folded. Lower molars as in *Mus*. Incisors narrow.

One species only is known.

270. *Vandeleuria oleracea*. The long-tailed Tree-Mouse.

Mus oleraceus, Bennett, P. Z. S. 1832, p. 121; Elliot, *Mud. Jour.* L. S. x, p. 214; Blyth, J. A. S. B. xxxii, p. 344; *id.* Cat. p. 120; Jerdon, *Mam.* p. 202.

Vandeleuria oleracea, Gray, A. M. N. H. x, p. 265 (1842); W. Sclater, P. Z. S. 1890, p. 532, pls. xlv, fig. 4, xlv, fig. 10; Thomas, P. Z. S. 1886, p. 65.

Mus (*Vandeleuria*) *dumeticola* and *Mus povensis*, Hodgson, A. M. N. H. xv, pp. 268, 269 (1845).

Mus badius, Blyth, J. A. S. B. xxviii, p. 295 (1859); *id.* Cat. p. 120; *id.* *Mam. Birds Burma*, p. 41.

Mus nilagiricus, Jerdon, *Mam.* p. 203.

Mus (*Vandeleuria*) *oleracea*, Anderson, *An. Zool. Res.* pp. 309, 313; Thomas, P. Z. S. 1881, p. 556.

Marad ilei, Can.; *Meina Yelka*, Tel. of Yanadis.

Fur soft. Tail much longer than the head and body. Ears thinly clad with hair, large, rounded. Mammaræ 8: 2 pairs pectoral, 2 inguinal.

Colour above light chestnut-red, varying from bright to dull, below white. Basal $\frac{2}{3}$ or more of dorsal hairs dark grey, termin-

ations rufous, a few long black tips intermixed on the rump. Ventral hair white throughout. Tail uniformly dark. Feet white. One specimen from Fatigarh, obtained by the late Mr. A. Anderson, has a rufous cross on the breast.

Dimensions. Head and body 2.2 to 3 inches, tail 3.5 to 4.5, ear about 0.5, hind foot 0.7; length of skull 0.85. *Mus nilagiricus* is slightly larger, head and body 3.5, tail 5.

Distribution. Throughout India (except in the extreme north-west), Ceylon, Assam, and Burma, extending to Yunnan. This species ascends the Himalayas to a moderate elevation and is found, if *M. nilagiricus* is the same, on the top of the Nilgiris.

Habits. The present species inhabits trees and shrubs, and makes a nest, usually of grass or grass and leaves, in the branches. The nest is often found in palms or bamboos, occasionally on the roofs of houses. Three young on one occasion, and four in another were brought to me in a nest. The animal is very active.

Genus **CHIROPDOMYS**, Peters (1868).

Hallux and rudimentary pollex with flat nails instead of claws, the other digits with strong much-curved claws. Plantar pads broad, oval. Skull short and broad. Anterior palatine foramina short. Anterior border of zygoma-root outside the infraorbital foramen vertical throughout, not emarginate above. Incisors narrow, not grooved. Molars tubercular, the transverse bands of enamel on the worn surface much more deeply plicated than in *Mus*, lower molars with a broad outer cingulum. Crowns of all the molars, above and below, when worn, traversed by two deep longitudinal furrows, one furrow, on the lower molars, just inside the cingulum.

Fig. 130.—(a) Upper and
(b) lower right molars
of *C. gliroides*, $\times 6$.

A single species.

271. *Chiropodomys gliroides*. *The penicillate-tailed Tree-Mouse*.

Mus gliroides, *Blyth, J. A. S. B.* xxiv, p. 721 (1855), xxxii, p. 345; *id. Cat.* p. 120.

Mus peguensis, *Blyth, J. A. S. B.* xxviii, p. 295 (1859), xxxii, p. 345, xxxiv, p. 193; *id. Cat.* p. 116; *id. Mam. Birds Burma*, p. 40.

Chiropodomys penicillatus, *Peters, M.B. Akad. Berl.* 1868, p. 448, pl. 1; *Doria, An. Mus. Civ. Genova*, ser. 2*, iv, p. 631.

Chiropodomys gliroides, *Thomas, P. Z. S.* 1886, p. 78; *W. Sclater, P. Z. S.* 1890, p. 532.

Fur soft, dense and even. Tail much longer than the head and body, thinly clad with hairs, which are short near the root of the tail but become longer towards the tip. Feet short and broad. Ears large, nearly naked, rounded. Vibrissæ copious and long. Mamæ 4, all abdominal.

Colour brown, not dark nor rufous, above, white or buffy white below. Basal $\frac{3}{4}$ of dorsal hair dark leaden grey, terminal portion light brown (fawn-colour), passing into darker brown at the end. A few longer black tips are scattered on the back. Ventral fur white throughout. A dark mark generally on each hind foot, remainder of the feet white. Tail dark throughout.

Dimensions of a male in spirit: head and body 3 inches, tail 4.5, ear 0.6, hind foot 0.75. A skull measures 0.93 in length.

Distribution. Khâsi hills, Kakhien hills, near Bhâmo, Manipur, Schwe Gyang, Malacca, Java, and Borneo.

(Genus **MUS**, Linn. (1766).

Form slender. Muzzle pointed; tail long, scaly. Fur soft or spiny, the spines when present fine and mixed with hair. Pollex rudimentary, with a small flat nail, all other toes (except in

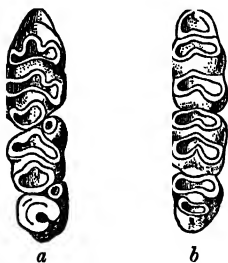


Fig. 131.—(a) Upper and (b) lower right molars of *M. rattus* (*M. rufescens*), $\times 4$.

M. chiropus) with compressed claws. Molars tubercular in the young; the tubercles of the upper molars in a triple longitudinal row, of the lower molars in a double row. The teeth when worn crossed by curved or folded transverse laminae. Incisors smooth, not grooved nor sculptured. Vertebrae: C. 7, D. 13, L. 6, S. 4, C. 26–32.

The genus is cosmopolitan and is largely represented in India. A great number of specific names have been given by various naturalists, and owing to imperfect descriptions, and to the difficulty of comparing the types, many of which were in England, Blyth in 'A Memoir

of the Rats and Mice of India,' published in 1863 (J. A. S. B. xxxi, p. 327), could only collect together the descriptions of about 50 nominal forms and indicate their affinities. Jerdon followed Blyth, and it was not until Thomas in 1881 re-examined Gray's and Hodgson's types with the aid of a large collection of Indian specimens that any important reduction of the overgrown list of names could be effected. Some additional identifications of Blyth's and Anderson's species have since been made by Mr. Thomas, and a few more are now added by the examination of some of Blyth's types, for the loan of which I am indebted to the Trustees of the Indian Museum, Calcutta, and to Mr. W. L. Sclater, who has independently examined the series in the Calcutta Museum and has come to conclusions that agree with my own (P. Z. S. 1890, p. 522). In the present work, by the aid of several observers, an attempt is made to identify all Indian, Ceylonese, and Burmese species hitherto described.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Six pads on planta; ears not covered with long hair; third upper molar much smaller than second.
- a. Large, head and body 4 to 9 inches; proximal plantar pad elongate, double length of next pad. (RATS.)
- a'. Lower surface of tail not white or not sharply divided from colour of upper surface.
- a''. Hair on terminal portion of tail not white.
- a². Outer border of infraorbital foramen deeply emarginate above.
- a⁴. Tail as long as head and body or longer.
- a. Head and body 5 to 8 in., hind foot 1·2 to 1·45; mammae 10-12 *M. rattus*, p. 406.
- β. Head and body 4 in., hind foot 0·9; mammae 8 *M. concolor*, p. 408.
- b⁴. Tail shorter than head and body, hind foot 1·5 to 1·7 *M. decumanus*, p. 408.
- b³. Outer border of infraorbital foramen slightly emarginate above; hind foot 1 inch *M. fulvescens*, p. 409.
- b''. Hair on terminal portion of tail white all round.
- a³. Colour above grey.
- a⁴. A brownish tinge on back; hind foot 2 inches *M. howersi*, p. 410.
- b⁴. Back pure grey; hind foot 1·4 .. *M. berdmorei*, p. 410.
- b³. Colour of upper parts brown; hind foot 1·3 *M. blanfordi*, p. 411.
- b'. Lower surface of body and tail white, or nearly white, sharply separated from colour of upper parts.
- a''. Hallux with a compressed claw.
- a³. Colour above rich rufous-brown *M. jerdoni*, p. 411.
- b². Colour above greyish brown *M. niveiventer*, p. 412.
- b''. Hallux opposable, with a flat nail *M. chiropus*, p. 413.
- b. Small, head and body less than 4 in.; proximal plantar pad not double length of next, and generally rounded. (MICE.)
- a'. Tail not shorter than head and body.
- a''. Hind foot without claws not exceeding 0·7 in.; mammae 10.
- a³. Lower parts fulvous or dusky *M. musculus*, p. 413.
- b³. Lower parts white *M. bactrianus*, p. 414.
- b''. Hind foot exceeding 0·7 in.
- a³. Fur dark brown above.
- a⁴. Malar bone concave externally .. *M. sublimis*, p. 415.
- b⁴. Malar convex externally *M. nitidulus*, p. 415.
- b³. Fur chestnut above; mammae 6 *M. arianus*, p. 416.

- b'*. Tail shorter than head and body.
a''. Fur spineless or mixed with flexible spines.
*a*³. Ear laid forward extending to eye .. *M. cervicolor*, p. 417.
*b*³. Ear not extending to eye *M. buduga*, p. 416.
b''. Dorsal fur mainly or wholly of inflexible spines *M. platythrix*, p. 418.
 B. Four or five plantar pads.
a. Back dark brown; hind foot about 1 in. .. *M. mettada*, p. 419.
b. Back sandy or fawn-colour; hind foot 0·7 in. *M. gleadowi*, p. 420.
 C. Ears covered with long hair; hind foot 0·32 in. *M. erythrotis*, p. 420.
 D. Second and third upper molars equal in size; hind foot 1 inch *M. kumei*, p. 421.

272. *Mus rattus*. *The common Indian Rat*.

- Mus rattus*, *Linn. Syst. Nat.* i, p. 83 (1766); *Blyth, Cat.* p. 113; *W. Sclater, P. Z. S.* 1890, p. 523.
Mus alexandrinus, *Geoff. Desc. de l'Egypte, Hist. Nat.* ii, p. 783, *Atlas*, pl. v, fig. 1 (1812); *Scully, P. Z. S.* 1881, p. 204; *Thomas, P. Z. S.* 1881, p. 533.
Mus indicus, *Geoff., Desm. Mam.* p. 299 (1822), *nec Bechstein*.
Mus rufescens and *asiaticus*, *Gray, Charlesworth's Mag. N. H.* i, p. 585 (1837).
Mus rattus and *flavescens* (*nec Waterhouse*), *Elliot, Mad. Jour. L. S.* x, pp. 212, 214.
Mus brunneusculus, *rattoides*, *nitidus*, and *horeites*, *Hodgson, A. M. N. H.* (1) xv, pp. 267, 268 (1845).
Mus æquicaudalis, *Hodgson, A. M. N. H.* (2) iii, p. 203 (1849).
Mus nemoralis, *Blyth, J. A. S. B.* xx, p. 168; *id. Cat.* p. 114.
Mus kandianus, *Kelaart, Blyth, ibid.* p. 169.
Mus rattus, *ceylonus*, *flavescens*, *nemoralis*, and *asiaticus*, *Kelaart, Prod.* pp. 58, 61–63.
Mus robustulus, *Blyth, J. A. S. B.* xxviii, p. 294 (1859); *id. Cat.* p. 114; *id. Mam. Birds Burma*, p. 39.
Mus crassipes, *Blyth, J. A. S. B.* xxviii, p. 295.
Mus (*Leggada*) *andamanensis*, *Blyth, J. A. S. B.* xxix, p. 103 (1860); *id. Cat.* p. 114.
Mus rattus, *andamanensis*, *nemoralis*, *rufescens*, *robustus*, *nitidus*, *horeites*, and *æquicaudalis*, *Blyth, J. A. S. B.* xxxii, pp. 338–344.
? *Mus infralineatus*, *Blyth, Cat.* p. 116 (no description).
Mus rattus, *infralineatus*, *brunneus*, *rufescens*, and *nitidus*, *Jerdon, Mam.* pp. 194, 197–201.
Mus palmarum, *Zelebor, Novarareise, Säugeth.* p. 26, pl. 3.
Mus sladeni and *yunnanensis*, *Anderson, An. Zool. Res.* pp. 305, 306.
Mus rattus rufescens, *Thomas, P. Z. S.* 1881, pp. 57, 71.

Chuha, Mûsa, H.; *Gachua-indur*, Beng.; *Kart yelli*, Tam.; *Ghasniyo*, Cing.

Fur variable, occasionally mixed with fine spines, more often spineless. Tail generally longer than the head and body (more rarely about equal or a little shorter). Ears moderately large, extending to the eye or occasionally beyond it, when laid forward. Mamæ 10–12: 2 or 3 pairs pectoral, 3 inguinal. Foot-pads 5 on the fore foot, 6 on the hind, the hindmost of the latter (proximal metatarsal pad) considerably elongated.

Skull very slightly convex above, the nasals sometimes greatly

produced. Lower portion of anterior border to zygomatic process of maxillary vertical, or slanting upwards and forwards, above rounded off to a deep emargination. Lower part of infraorbital foramen narrow, with a swelling in front on the maxillary bone. The fronto-parietal area pyriform, the low crest bordering the parietal region convex throughout. Incisors narrow; first upper molar much larger than the second, which is nearly double the size of the third.

Colour above in Indian specimens usually brown, more or less rufous or occasionally yellowish brown; more rarely blackish brown or black; below generally white, frequently sullied, sometimes brown or grey and occasionally with a white, fulvous, or grey median band. Basal three fourths of the dorsal hairs dark grey, the terminal fourth mostly light brown, mixed with longer black tips. When spines are present they are whitish near the base. Tail generally the same colour throughout, but sometimes paler beneath. Feet generally white. Incisors orange.

Dimensions. Head and body 5 to 8 inches, tail $\frac{5}{8}$ to 9 or even more, hind foot without claws 1.2 to 1.5 ear $\frac{7}{10}$ to 1. An average skull is 1.5 long by $\frac{75}{100}$ broad.

Distribution. Almost world-wide, doubtless from being introduced. Probably indigenous in India and found throughout the country, also in Burma and Ceylon, from the sea-level to an elevation of at least 8000 feet.

Varieties. The typical *Mus rattus* of Europe, the black rat, is doubtless an introduced form. This variety is occasionally found in various parts of India, chiefly large ports, whither it has probably been brought by shipping. Besides this there are three Indian varieties requiring notice:—

1. *M. alexandrinus*.—Size generally large; colour above brown without much rufous tinge, below usually white. The tail is longer than the head and body. This form is found in Western India and extends thence to Northern Africa. Some specimens from Simla have the under surface of the tail quite white.
2. *Mus nitidus*.—This differs from the last in having finer fur often mixed with numerous spines, and in the tail differing but little in length from the head and body, being sometimes rather longer, sometimes a little shorter. Soles of feet often white. The common Eastern Himalayan form.
3. *Mus rufescens*.—A more slender and frequently smaller variety, with a long tail, generally spinous hair, and a rufous or yellowish-brown tint. The variety chiefly found in the Indian Peninsula, Ceylon, and Burma. More arboreal than the others.

Thomas, from whom I take most of these details, has shown that the length of the nasal bones varies in specimens from one locality from 46 to 69 per cent. of the length of the skull.

Mus infralineatus was founded on a small short-tailed specimen with a dark median line on the chest; *Mus andamanensis* on a very spiny variety (I have examined the type); and *Mus yunnanensis* on

a form with unusually short hind feet. Like most widely diffused forms, this species is very variable.

Habits. This rat is found both on the ground, where it burrows, and in trees, where it builds nests amongst the branches. In the Laccadive Islands and other places it inhabits the crowns of cocoa-nut palms, and is said never to descend to the ground, but to live on the nuts and to do great damage by biting them off when unripe. It is common in houses everywhere, often living in the roofs. It feeds chiefly on fruit, grain, and vegetables, but is more or less omnivorous, though less carnivorous than *M. decumanus*. The young, which are produced several times in the year, are usually 7 to 9 in number and are born with the eyes closed.

273. *Mus concolor.* *The little Burmese Rat.*

Mus concolor, Blyth, *J. A. S. B.* xxviii, p. 295 (1859), xxxii, pp. 73, 344; *id. Cat.* p. 116; *id. Mam. Birds Burma*, p. 40; Anderson, *Fauna Mergui Archip.* i, p. 341; W. Slater, *P. Z. S.* 1890, p. 526.

Fur harsh, chiefly composed on the back of flattened hairs or fine spines. Tail longer than the head and body. Ears reaching the eye when laid forward. Hindmost metatarsal pad elongate. Mammæ 8: 2 pairs pectoral, 2 inguinal. Skull similar to that of *M. rattus* in shape though much smaller; third upper molar about half the size of the second.

Colour above brown, slightly rufescent, lower parts paler brown; basal half of the dorsal hair grey, which passes gradually into brown, the tips being dark brown (probably black in fresh skins), fur of lower parts grey at the base. Tail brown throughout.

Dimensions of an adult male in spirit: head and body 4 inches, tail 4·35, ear from crown 0·45, hind foot 0·92; in another 4·5, 5·25, 0·55, and 1; in an adult female 4·1, 4·85, 0·55, and 0·85; extreme length of skull 1·1.

Distribution. Hitherto only recorded from Pegu and Tenasserim (Thayet Myo, Schwe Gyeng, the neighbourhood of Moulmein, Mergui and the Mergui Archipelago), but probably found also in Malacca.

A house-rat, inhabiting wooden buildings, and especially the thatch. This species is a small rat rather than a large mouse, and is structurally a miniature of *Mus rattus*.

274. *Mus decumanus.* *The brown Rat.*

Mus decumanus, Pallas, *Glores*, p. 91 (1779); Elliot, *Mad. Jour. L. S. x*, p. 212; Kelaart, *Prod.* p. 59; Blyth, *J. A. S. B.* xx, p. 167, xxxii, p. 335; *id. Cat.* p. 113; *id. Mam. Birds Burma*, p. 39; Jerdon *Mam.* p. 195; Thomas, *P. Z. S.* 1881, p. 532.

Mus decumanoides, Hodgson, *J. A. S. B.* x, p. 915 (no description).

Mus brunneus, Hodgson, *A. M. N. H.* xv, p. 266 (1845).

Chuha, Ghar-ka-chuha, H.; Demsa-indur, Beng.; Kut-elli, Tam. Mani-ilei, Can.; Graval-Miyo, Cing.; Kymek, Burmese.

Fur coarse and harsh. Tail shorter than the head and body. Ears short. Feet large. Mammæ 10-12.

Colour above brown, darkest on the back; lower parts white, or whitish brown or light brown. Underfur dark-coloured throughout the body, on the back slaty grey; the terminal portion of the dorsal hairs in general light brown, but numerous longer black hairs are intermixed. Tail brown throughout.

Dimensions. An adult male measured: head and body 7 inches, tail 6.25, ear from orifice 0.77, hind foot 1.65; another, head and body 8, tail 6; a third 10.5 and 8.25, and probably even larger specimens might be found. Basal length of an average skull 1.65, extreme length 1.8, zygomatic breadth 0.9. A large Calcutta male skull is 2.15 inches long.

Distribution. This rat is certainly not indigenous in India, though now found in all large towns and villages, along the banks of navigable rivers and on high roads. It is unknown in Persia, and, it is said, in Afghanistan, but will probably be introduced when wheeled carriages take the place of pack animals in those countries. The source whence this rat has been distributed throughout the world is probably Chinese Mongolia.

Habits. As is well known, the brown rat is omnivorous and voracious; it is essentially parasitic, living about human habitations and cultivations, burrowing in houses, banks of fields, drains, &c. It is excessively prolific, breeding several times in the year, and producing from 4 to 12, or at times even more, young at a birth.

The brown rats in Calcutta grow to a large size and are often mistaken for bandicoots. They probably attain similar dimensions in some other Indian towns.

275. *Mus fulvescens*. The chestnut Rat.

Mus fulvescens, Gray, *Cat. Mam. &c. Nepal & Thibet B. M.* (1) p. 18 (1846); Thomas, *P. Z. S.* 1881, p. 537; W. Sclater, *P. Z. S.* 1890, p. 524.

Mus caudator, Hodgson, *A. M. N. H.* (2) iii, p. 203 (1849) (no description); Jerdon, *Mam.* p. 201; Blyth, *Mam. Birds Burma*, p. 40.

? *Mus cinnamomeus*, Blyth, *J. A. S. B.* xviii, p. 294 (1859), xxxii, p. 341, xxxiv, p. 193; *id. Cat.* p. 115.

Fur soft, generally without spines, but sometimes with flat spines intermixed. Tail longer than the head and body and having the hairs near the end a little longer and thicker than near the base. Teeth small. Anterior edge of zygomatic process of maxillary nearly vertical and but slightly emarginate above, much less so than in other species. Mammæ 8: 2 pairs pectoral and 2 inguinal.

Colour above bright rufous-brown, the back but little darker than the sides, sometimes mixed with grey; below white, and in one skin with a fulvous band down the middle of the breast. The dorsal and ventral colours sharply separated on the sides. Basal $\frac{3}{4}$ of dorsal hair leaden grey, terminal portion yellowish brown, the

extremities darker, a few longer hairs black-tipped. Spines when present whitish except at the end. Tail dark, the same colour above as below.

Dimensions. Head and body, 5·25 to 6, tail 7 to 8·4, ear from outer base 0·9, hind foot 1; total length of skull 1·3, breadth 0·6; weight 2½ oz.

Distribution. Nepal and Sikhim. Several specimens were obtained at Darjiling in houses by Mr. Hodgson.

Mus cinnamomeus, Blyth, was united to *Mus caudatior*, which is the same as *Mus fulvescens*, by Mr. Blyth himself. The colour, however, is much paler, the teeth considerably larger, and the anterior border of the maxillary zygomatic process much more emarginate. The type of *M. cinnamomeus* was from Schwe Gyeng, Burma, and measured, head and body about 6 inches, tail 7·75, hind foot 1·25. Further specimens are required to show whether this is the same as *M. fulvescens* or distinct.

276. *Mus bowersi*. *Anderson's Rat*.

Mus bowersi, *Anderson, An. Zool. Res.* p. 304, pl. xvii (1878); *Thomas, P. Z. S.* 1886, p. 62; *W. Sclater, P. Z. S.* 1890, p. 524, pl. xliv, fig. 2 (skull).

Fur thin, harsh and coarse, without spines, growing from the roots in small tufts of 3 or 4 hairs. Tail exceeding the head and body in length, and but thinly clad with very short hair. Ears large, almost naked. Mammaræ 8: pectoral 2 pairs, inguinal 2.

Skull long, fronto-nasal portion elongate, and very straight above. Infraorbital foramen widely open below; the anterior border of the maxillary zygomatic process vertical at the lower base, then rounded, deeply emarginate above.

Colour above dark greyish brown (earthy brown), slightly grizzled, sides paler, lower parts white or pale yellow. No dark grey underfur; dorsal hairs whitish at the base, becoming gradually darker till they are blackish brown near the end, the extreme tip whitish. Longer piles are intermixed having long black points. Tail brown throughout, except the terminal portion, varying from $\frac{1}{8}$ to $\frac{1}{2}$, which is pale with white hair.

Dimensions. Head and body 9 inches, tail 10·25, ear 1·15, hind foot 2·15; basal length of skull 1·9, extreme length 2·1, zygomatic breadth 1·1.

Distribution. Hotha in Yunnan, Machi in Manipur, Karennee, and Tenasserim (*Fea*). Probably a tree-rat. A single specimen from the Andamans in the British Museum belongs either to a variety of *M. bowersi* or to a closely allied form.

277. *Mus berdmorei*. *The grey Rat*.

Mus berdmorei, *Blyth, J. A. S. B.* xx, p. 173, note (1851), ? xxiv, p. 712, xxxii, p. 343; *Thomas, P. Z. S.* 1886, p. 62; *W. Sclater, P. Z. S.* 1890, p. 525.

Fur coarse, moderately long, without spines. Tail about the same length as the head and body. Ears rounded. Nasal portion of skull long; the upper molars proportionally small, very distant from the incisors, which are directed forward. Mammæ 10.

Colour above dark ashy grey, grizzled or speckled, without any rufous or yellow admixture, below white. Dorsal hairs slaty grey from the base to near the tip, then there is a whitish subterminal ring and a blackish tip, the latter often wanting. Tail bicoloured; the upper surface of the basal half brown, the lower surface of the basal and the whole of the terminal half pale, with whitish or white hair. Feet white.

Dimensions taken from skins: head and body 7 inches, tail 6·9, hind foot 1·4, ear from crown 0·65; total length of skull about 1·5, zygomatic breadth 0·8. Some skins may indicate a larger size.

Distribution. The type, of which only the skull is now preserved, came from Mergui; specimens have since been obtained by Mr. Fea east of Moulmein, by Mr. Hume in Manipur, and I have a skin from the Khâsi hills. From these the above description is taken.

278. *Mus blanfordi.* *The white-tailed Rat.*

Mus blanfordi, *Thomas, A. M. N. H.* (5) vii, p. 24 (1881); *id. P. Z. S.* 1881, p. 541, pl. 1.

Fur long and soft, without spines. Tail longer than the head and body, hair on the terminal portion conspicuously longer and thicker. Feet broad, digits short. Mammæ 6 in the only female examined: 1 pair axillar, 2 inguinal. Fronto-parietal suture of skull forming almost a right angle in the middle. Anterior palatine foramina long.

Colour brown above, white below, the sides paler than the back. Basal three quarters or more of the dorsal fur leaden grey, terminal portion light brown or isabelline, the longer hairs on the back with long black tips. Feet white in old specimens, brownish in younger individuals. Tail brown at the base and for half to three-quarters the length, the terminal portion pale, clothed with longer white hairs.

Dimensions of adult male in spirit: head and body 6 inches, tail 8, hind foot 1·33; extreme length of skull 1·65, basal length 1·6, zygomatic breadth 0·8.

Distribution. Madras Presidency. This species has been found near Cuddapah by Col. Beddome, on the Nilgiri hills by Mr. Davison, and on the Shevaroy by Mr. Daly. It is probably a hill form.

279. *Mus jerdoni.* *The bicoloured Rat.*

Leggada jerdoni, *Blyth, J. A. S. B.* xxxii, p. 350 (1863); *Jerdon, Mam.* p. 209.

♀ *Mus octomammis*, *Hodgson, Cat. Mam. &c. Nepal & Thibet B. M.* 2nd ed. 1863, p. 10 (no description).

Mus jerdoni, *Blyth, Cat.* p. 121; *Thomas, P. Z. S.* 1881, p. 537.

Fur long, usually mixed with flattened spines. Tail considerably

longer than the head and body. Mammæ 8: 2 pairs pectoral, 2 inguinal. Planta short. Ears large. Skull nearly flat above; nose elongate, anterior border of maxillary zygomatic process convex below, concave but not deeply emarginate above; bullæ small.

Colour above bright rufous-brown, darker on the back than on the sides, lower parts white, the colours sharply divided. Basal three-fourths of dorsal hair slate grey, tips dull orange, the spines whitish with long black tips; ventral hair white throughout. Tail distinctly bicoloured throughout, dusky above, white below, the two colours contrasting strongly. Feet, as a rule, white, but the dark colour of the tarsus sometimes extends to the base of the digits.

Dimensions. Head and body of an adult female 5.5 inches, tail 7, hind foot 1.2, ear from orifice 0.75. Of another the head and body measured 5.4, tail 8.5, basal length of a skull 1.3, extreme length of skull 1.6.

Distribution. Eastern Himalayas at elevations of from 4000 to 7000 feet, Khâsi hills, Tenasserim (Fæa), Java, and perhaps Formosa (*M. coxingi*); probably a hill-species everywhere. The Western Himalayan specimens mentioned by Jerdon are referred by Thomas, probably with justice, to another species.

280. *Mus niveiventer.* *The white-bellied Rat.*

Mus (Rattus) niviventer, Hodgson, *J. A. S. B.* v, p. 234 (1836); Blyth, *J. A. S. B.* xxviii, p. 295, xxxii, p. 342.

Mus niviventer, Jerdon, *Mam.* p. 200; Thomas, *P. Z. S.* 1881, p. 540.

Fur of moderate length, sometimes thickly mixed with flattened spines, sometimes without spines. Tail a little longer than the head and body, with the hair towards the tip rather longer and thicker than elsewhere. Skull very similar to that of *M. jerdoni*.

Colour dull brown above, with more or less of a greyish tinge, sides a little paler than the back, lower parts white, the colours sharply divided on the sides. Basal two-thirds or more of the dorsal fur leaden grey, spines whitish, terminal portion of hairs isabelline (whity brown), the spines with long black tips. Feet whitish. Tail distinctly bicoloured, the upper surface dark brown, lower whitish or white.

Dimensions. Head and body 5.25 inches, tail 6, hind foot 0.92; extreme length of skull about 1.3. Blyth gives larger dimensions for specimens from Mussooree.

Distribution. Himalayas from Simla to Katmandu in Nepal. Jerdon adds Darjiling, but he possibly mistook spineless specimens of *M. jerdoni* for the present form.

Besides being much greyer in colour, the present species is distinguished from *M. jerdoni* by having a comparatively shorter tail.

281. *Mus chiropus*. *Fea's Rat*.

Mus chiropus, *Thomas, Ann. Mus. Civ. Gen.* 2 a, x (1891).

Similar in size and proportions to *M. jerdoni*, but with the hallux opposable and, like the pollex, furnished with a flat nail in place of a claw. Fur long, not spinous, but with a few flattened bristles intermixed. In the skull the anterior border of the maxillary zygomatic process slopes slightly backward from the lower end, and is nearly straight throughout, being scarcely emarginate above.

Colour above rufous-brown, sides and outer surfaces of limbs bright rufous, lower parts white, the colours sharply defined. Tail dark above, pale below.

Dimensions. Head and body of an adult male in spirit 5 inches, tail 8, hind foot 1·2, ear 0·6; basal length of skull 1·25, extreme length 1·5.

Distribution. Karenuee. A single specimen was obtained by Mr. L. Fea at an elevation of about 4500 feet above the sea.

282. *Mus musculus*. *The common House-Mouse*.

Mus musculus, *Linn. Syst. Nat.* xii, p. 83; *Elliot, Mad. Jour. L. S.* x, p. 214; *Blyth, J. A. S. B.* xxi, p. 351, xxviii, p. 296.

Musculus nipalensis, *Hodgson, J. A. S. B.* x, p. 915 (no description).

Mus manei, *Gray, List Mam. B. M.* p. 111 (1843) (no description); *Kelaart, Prod.* p. 64; *Blyth, J. A. S. B.* xxix, p. 103.

Mus urbanus, *Hodgson, A. M. N. H.* xv, p. 269 (1845); *Blyth, J. A. S. B.* xxxii, p. 345; *id. Cat.* p. 118; *Thomas, P. Z. S.* 1881, p. 544; *W. Sclater, P. Z. S.* 1890, p. 527.

Mus dubius, *Hodgson, ibid.* p. 268.

Mus homourus, *Hodgson, ibid.* p. 268; *Blyth, J. A. S. B.* xxxii, p. 346; *id. Cat.* p. 118.

Mus darjeelingensis, *Hodgson, A. M. N. H.* (2) iii, p. 203 (1849) (no description); *Horsfield, Cat.* p. 143.

? *Mus tytleri*, *Blyth, J. A. S. B.* xxviii, p. 296, xxxii, p. 346.

Mus rama, *Cantor, Blyth, J. A. S. B.* xxxiv, pt. 2, p. 194.

Mus urbanus, *homourus*, *darjeelingensis*, and *tytleri*, *Jerdon, Mam.* pp. 203-205.

Mus kakhienensis and *viculorum*, *Anderson, An. Zool. Res.* pp. 307, 308.

Musi, *Chuhi*, *Mesuri*, H.; *Chutu*, Kol.; *Lengtia indur*, Beng.; *Manei buduga*, Can.; *Kusettamiyo*, Cing.; *Shintad gandu*, Wadāri, Ahmednagar.

Fur short, without spines. Tail almost naked, generally longer than the head and body, but sometimes the same or even a little less. Ears rounded, extending to the eye when laid forward. Mammæ 10: 3 pairs pectoral, 2 inguinal. Skull convex above; third molar in both jaws very small, about one third the size of the second.

Colour above varying from dark to light brown, below paler and

greyer, but never white. Underfur dark ashy grey throughout the body; tips on the back light brown, generally but not always mixed with longer black terminations. Tail the same dark colour throughout.

Dimensions. Head and body 2·5 to 3 inches, tail 2·5 to 3·5, ear 0·4 to 0·5 from orifice, hind foot 0·6 to 0·7. The above are from fresh specimens. A skull measures 0·92 in extreme length and 0·43 in breadth.

Distribution. Found in houses everywhere in India except in the Punjab, Sind, Rajputána, and part of the North-West Provinces; also found throughout Ceylon and Burma. It is difficult to say whether this species is indigenous or introduced. *Mus musculus* is of almost world-wide distribution.

Varieties and Synonymy. I have followed Mr. Thomas in reuniting the Indian with the European house-mouse, for after going over the collections in the British Museum, I can find no constant distinctions between them. The differences mentioned by Blyth and quoted by Jerdon are certainly not constant. The Himalayan form *Mus homourus* has in general a shorter tail than the common mouse of the plains (*M. urbanus*), and the fur is longer and softer, in accordance with the colder climate of the Himalayas. It is, I think, probable that *M. tyleri* should be assigned to *M. bactrianus*, but as no type is known this question cannot be determined.

Habits. The common mouse is chiefly found in houses, but sometimes in gardens and fields near villages and towns. It is excessively active, climbing vertical walls of considerable height, and springing farther than most allied species. It is omnivorous, living mainly, however, on grain and the remains of men's food. It breeds from 3 to 5 times in the year and produces at each birth from 4 to 8 young, which are born blind, but attain full growth and are capable of propagation in less than a year.

283. *Mus bactrianus.* *The Persian House-Mouse.*

Mus bactrianus, Blyth, *J. A. S. B.* xv, p. 140 (1846), xxxii, p. 347, xxxiv, p. 193; Jerdon, *Mam.* p. 206; Blanford, *Eastern Persia*, ii, p. 56, pl. v, fig. 2; Thomas, *P. Z. S.* 1881, p. 546.

Mus gerbillinus and *theobaldi*, Blyth, *J. A. S. B.* xxii, pp. 410, 583.

Mus gerbillinus, Blyth, *Cat.* p. 119.

Structure similar to that of *Mus musculus*, except that the tail is generally rather shorter than the head and body, rarely longer in fresh specimens.

Colour above light sandy brown or fawn-colour, below white, the two colours not sharply separated. Basal three-fourths of dorsal hairs slaty grey, tips light brown; a varying number of black tips intermixed. On the lower parts the fur is sometimes pale grey at the base. Tail dark above, pale beneath.

Dimensions. A good-sized male (fresh) measured: head and body 3·5 inches, tail 3·3, ear from orifice 0·55, hind foot 0·7. Extreme length of a skull 0·88. Some specimens are considerably smaller.

Distribution. Throughout South-western Asia, extending into North-western India and to Egypt. This is the common house-mouse in Sind, the Punjab, and Western Rajputána, and is also found in Kashmir and Ladák.

284. *Mus sublimis*. *The upland Mouse*.

Mus sublimis, *Blanford, Yark. Miss., Mam.* p. 51; *Scully, A. M. N. H.* (5) viii, p. 99 (1881); *W. Sclater, P. Z. S.* 1890, p. 528.

Fur soft and rather long. Tail exceeding the head and body in length. Ears moderately large. Skull with frontal and nasal portion nearly straight and the zygomatic arches distinctly concave on their outer surfaces.

Colour brown above, whitish below, all the hair except the tips dark slaty grey throughout the body, tips of the dorsal hairs light brown, longer hairs with dark brown or black tips being intermixed in abundance.

Dimensions of a female in spirit: head and body 2·6 inches, tail 3·05, ear from orifice 0·5, hind foot 0·83; length of skull 0·92.

Distribution. The type was obtained by Dr. Stoliczka at Tankse west of Pangong Lake, Ladák, at an elevation of 13,000 feet. Another specimen is recorded by Scully from Astor, at 11,000.

This form may turn out to be a variety of *M. musculus*.

285. *Mus nitidulus*. *Berdmores Mouse*.

Mus nitidulus, *Blyth, J. A. S. B.* xxviii, p. 294 (1859), xxxii, p. 347; *id. Cat.* p. 119; *id. Mam. Birds Burma*, p. 40; *Thomas, P. Z. S.* 1881, p. 550; *W. Sclater, P. Z. S.* 1890, p. 529.

Fur long, sometimes spiny, sometimes not. Tail equal to the head and body, or longer, uniformly clad with very short hairs. Ears large, rounded. Hind foot longer than in *M. musculus*, hinder metatarsal pad slightly long. Skull elongate, fronto-parietal suture nearly straight instead of deeply concave; anterior border of zygomatic process of maxillary sloping backwards and upwards from the base.

Colour above brown with but little rufous tinge, below white somewhat sullied. Underfur grey throughout the body; tips of the fine hair on the back pale brown, of the spines dark brown, probably black in some specimens. Tail dark above, pale below.

Dimensions of an adult female in spirit: head and body 3·1 inches, tail 3·52, ear 0·48, hind foot 0·77; extreme length of skull 0·93.

Distribution. The type, now lost, was procured at Shwe Gyeng in Burma by Captain Berdmores. Mr. Thomas has identified with this species specimens from Sikhim, Bhámo, and Karennee. One from the Khási hills is referred to *nitidulus* by Mr. W. Sclater with some doubt.

286. *Mus arianus*. *The Persian long-tailed Field-Mouse.*

Mus erythronotus, *Blanford, A. M. N. H.* (4) xvi, p. 311 (1875); *id. Eastern Persia*, ii, p. 54, pl. v, fig. 3; *id. Yark. Miss., Mam.* p. 54; *id. J. A. S. B.* xlviii, pt. 2, p. 97; *nec Temminck*.
Mus arianus, *Blanford, A. M. N. H.* (5) vii, p. 162 (1881); *Scully, P. Z. S.* 1881, p. 205; *Thomas, P. Z. S.* 1881, p. 548; *Buchner, Wiss. Res. Przevalski Reis., Säugth.* p. 90; *W. Sclater, P. Z. S.* 1890, p. 528.

Fur soft, spineless. Tail about equal to the head and body, sometimes a little shorter or longer, thinly clad with hair, which becomes longer towards the extremity. Ear when laid forward reaching the eye, thinly clad. Proximal metatarsal pad small, not elongate. Maminae 6: 2 pairs inguinal, 1 pectoral. Skull elongate. Third upper molar about half as large as the second. Anterior palatine foramina not extending back as far as the molars.

Colour rufous-brown above, white or pale yellowish grey below, the two colours sharply divided, back darker than sides. Underfur dark grey throughout the body, terminal fourth of the hairs on the back chestnut, mixed with longer black tips. Upper lips white. Tail-hair black or mixed black and white above to the end, white on the sides and below.

Dimensions of a male: head and body 4 (in spirit 3·5), tail 4·2, ear 0·7, hind foot 0·85; length of skull 1·1.

Distribution. This species has a wide range in Central Asia, being found in Persia, Eastern Turkestan, and the Central Tianshan. It has only occurred within Indian limits in Gilgit, where it is common from 5000 to 10,000 feet elevation.

Habits. Found in cultivated fields and on grassy downs near forests. This mouse enters houses in winter. It has doubtless the same habits as its near European ally *Mus sylvaticus*.

This mouse represents in Central Asia the European *M. sylvaticus* and the Chinese *M. chevrieri*. All the three are closely allied.

287. *Mus buduga*. *The common Indian Field-Mouse.*

Leggada booduga, *Gray, Charlesworth's Mag. Nat. Hist.* i, p. 586 (1837).

Mus lepidus, *Elliot, Mad. Jour. L. S.* x, p. 216 (1839); *Blyth, Cat.* p. 121.

Mus terricolor, *Blyth, J. A. S. B.* xx, p. 172 (1851), xxxii, p. 349; *id. Cat.* p. 119; *Jerdon, Mam.* p. 206.

Mus fulvidiventris and albidiventris, *Blyth, J. A. S. B.* xxi, p. 351, xxxii, p. 349.

Mus cervicolor, *Kelaart, Prod.* p. 64, *nec Hodgson*.

Leggada lepidus, *Blyth, J. A. S. B.* xxxii, p. 350; *Jerdon, Mam.* p. 209.

Mus beavani, *Peters, P. Z. S.* 1866, p. 559; *Blyth, Mam. Birds Burma*, p. 40.

Mus (Leggada) buduga, *Thomas, P. Z. S.* 1881, p. 553; *W. Sclater, P. Z. S.* 1890, p. 531.

Shinjâd-phârka, Shintâd-bhurka, Wadâ-i; Chitta Yelka, Tel. of Yanadis.

Fur short and close, often but not always spiny. Tail slender,

nearly naked, considerably shorter than the head and body. Ear moderate, rounded, thinly clad. Feet small; planta narrow, the proximal pair of plantar pads small, close together and near the next pair, so that all the pads are more distally situated than in *M. musculus*. Mammæ 10: 3 pairs pectoral, 2 inguinal.

Skull more depressed than in *M. musculus* and occipital region flatter. Lower portion of infraorbital foramen more open, and anterior border of maxillary zygomatic-root usually convex to the base. First upper molar sometimes with an additional anterior cusp and often with an elongate anterior spur with or without a cusp. In some cases both cusp and spur are wanting.

Colour above varying from pale sandy to dark greyish brown, below white. Basal half or more of dorsal fur dark grey, tips brown, a few longer hairs with black terminations intermixed on the rump. Underfur on lower parts sometimes grey. Tail paler below.

Dimensions. Head and body 2·4 to about 3 inches, tail 2·1 to 2·7. A male in spirit measured: head and body 2·8, tail 2·45, ear 0·4, hind foot 0·65. Extreme length of a skull 0·75.

Distribution. The Peninsula of India and Ceylon generally. Not recorded from the Indus valley (except from Karáchi) or the Himalayas. I have specimens from Ajmere and from Fatehgarh, N.W.P. Blyth's Burmese locality for *Mus beavani* is, I think, probably due to some mistake, but a specimen was obtained at Bhámo by Mr. Fea.

Habits. Common in fields, living in small burrows, often under roots or stones; found also in gardens, in wood, and sometimes in houses. Jerdon states that a little heap of stones is generally found near the hole of this mouse. Usually only a pair of *M. buduga* are found in one burrow. This species was found in houses by Kelaart and by Jerdon, for the description, under *M. darjilingensis* (Mam. p. 205), of a house-mouse found by the latter at Jalna and Nagpur clearly refers to the present form.

Gray's name *booduga* was perhaps derived by some complicated process from *bhurka*.

288. *Mus cervicolor*. The fawn-coloured Mouse.

Mus cervicolor, Hodgson, *A. M. N. H.* xv, p. 268 (1845); Blyth, *J. A. S. B.* xxxii, p. 349; *id.* *Cat.* p. 119; Jerdon, *Mam.* p. 206; Thomas, *P. Z. S.* 1881, p. 547, 1886, p. 65.

Mus strophinatus, Hodgson, *ibid.*; Blyth, *J. A. S. B.* xxxii, p. 349.

Mus cunicularis, Blyth, *J. A. S. B.* xxiv (1855), p. 721, xxxii, p. 348; *id.* *Cat.* p. 119.

Fur soft, spineless. Ears large, extending to the eye when laid forward. This mouse is similar in other details of structure to *Mus buduga*.

Colour dark fawn or moderately pale rufescent brown to darker brown above, white below; underfur dark grey throughout, longer black terminations mixed with the light brown tips of the dorsal fur. Tail the same colour throughout.

Dimensions. Head and body 2·9 inches, tail 2·65, ear 0·5, hind foot 0·65; skull 0·8.

Distribution. Nepal, Eastern Bengal, Assam, and the Khási hills. Specimens from the neighbourhood of Calcutta, originally described as *M. albidiventris* and subsequently referred to this species by Blyth, are shown by Mr. W. Slater to belong to *M. buduga*. It is doubtful whether *M. buduga* and *M. cervicolor* should be kept distinct.

289. *Mus platythrix*. The brown spiny Mouse.

Mus platythrix, Bennett, P. Z. S. 1832, p. 121; Elliot, *Mad. Journ. L. S.* x, p. 215; Blyth, *Cat.* p. 121.

Leggada platythrix, Gray, *Charlesworth's Mag. N. H.* i, p. 586; Blyth, *J. A. S. B.* xxxii, p. 350; Jerdon, *Mam.* p. 207.

Mus spinulosus, Blyth, *J. A. S. B.* xxiii, p. 784 (1854), xxix, p. 111; *id.* *Cat.* p. 121.

Leggada spinulosa, Blyth, *J. A. S. B.* xxxii, p. 349; Jerdon, *Mam.* p. 268.

Mus (Leggada) platythrix, Thomas, P. Z. S. 1881, p. 553; W. Slater, P. Z. S. 1890, p. 531.

Leggyade, *Legadgandu*, or *Rále-lagangandu*, Wadári; *Gijeli-gandu*, Tel. of Yanadis; *Kal ilei*, Can.

Fur above and below composed almost entirely of flattened spines, those on the back stiff and coarser than those on the lower parts. Tail shorter than the head and body, rather thick at the base, clad with short hair, rather more thickly than in *Mus* generally. Ears short, rounded. Mammæ 10: 3 pairs pectoral, 2 inguinal. Hind foot small, all the 6 pads near together, the metatarsal pair small, round, and distant from the heel. Anterior palatine foramina long, extending back to the middle of the first molar; anterior edge of maxillary zygoma-root straight. First upper molar normally very long, with an anterior spur bearing a distinct cusp, but in some skulls the spur is wanting and the cusp rudimentary. Third upper molar about one third the size of the second.

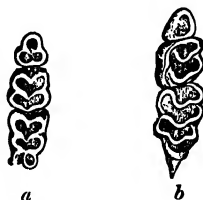


Fig. 132.—(a) Upper and (b) lower right molars of *M. platythrix*, $\times 5$.

Colour above dark brown, occasionally paler, below white, the separation of the two colours well defined. Basal half of dorsal fur grey, terminal half brown, a few longer black points being mixed on the rump. Tail-hairs dark above, white below.

Dimensions. Head and body of an adult male (in spirit) 3·3 inches, tail 3, ear 0·4 (from orifice 0·5), hind foot 0·7. Skull 1 inch long.

Distribution. The peninsula of India and Ceylon. This form has been obtained in the Punjab, in Sind, and in Malabar, but not in Bengal.

Habits. According to Sir W. Elliot, "the Leggyade lives entirely in the red gravelly soil in a burrow of moderate depth, generally

on the side of a bank. When the animal is inside the entrance is closed with small pebbles, a quantity of which are collected outside, by which its retreat may always be known. The burrow leads to a chamber in which is collected a bed of small pebbles on which it sits. Its food appears to be vegetable. In its habits it is monogamous and nocturnal."

The genus *Leggada* of Gray, classed apart from *Mus* by Jerdon and some others, was founded on *Mus buduga*, but the present species, which was included, is more characteristic. The only important distinction is the form of the anterior upper molar, and that is variable, there being, in *Mus buduga*, a complete passage to the ordinary murine form of the tooth.

290. *Mus mettada*. The metad Rat, or soft-furred Field-Rat.

Golunda mettada, Gray, *Charlesworth's Mag. N. H.* i, p. 586 (1837)

Blyth, J. A. S. B. xxxii, p. 352; *Jerdon, Mam.* p. 218.

Mus mettade and *M. lanuginosus*, *Elliot, Mad. Jour. L. S.* x, pp. 208, 212.

Mus mettada, *Blanford, J. A. S. B.* xlv, pt. 2, p. 290, pl. i; *Thomas, P. Z. S.* 1881, p. 550; *W. Sclater, P. Z. S.* 1890, p. 530.

Mettád, Mettangandu, Wadári.

Fur dense, fine and soft, without spines. Tail about the same length as the head and body or rather less, not pencilled. Ears rounded, moderately large, very thinly clad with short hair. Planta with 4 or 5 pads only. Mammæ 8: 2 pairs pectoral; 2 inguinal. Skull convex above, anterior palatine foramina long.

Colour above dark greyish brown (earthy brown), paler on the sides, and white below. Basal three fourths or more of the dorsal fur leaden black; tips light brown, mixed on the back with numerous rather longer black terminations. Basal portion of fur on lower parts very dark grey. Feet whitish. Hairs on tail dark brown above, white below.

Dimensions of a male in spirit: head and body 5 inches, tail 4.2, ear from orifice 0.75, hind foot 1.05; extreme length of skull 1.38, basal length 1.2, zygomatic breadth 0.63.

Distribution. Found in several parts of the Peninsula of India—Etawah and Banda, Ahmednagar, Dharwar, Cuddapah, Anaimalai hills, and various other parts of the Madras Presidency. Mr. Murray has obtained this species in Sind. The Ceylon specimens mentioned by Blyth (*J. A. S. B.* xx, p. 167) were, however, wrongly identified.

Habits. These have been described by Sir W. Elliot, who says:—"The Mettade lives entirely in cultivated fields, in pairs or small societies of five or six, making a very slight and rude hole in the root of a bush, or merely harbouring among the heaps of stones thrown together in fields, in the deserted burrow of the kok, or contenting itself with the deep cracks and fissures formed in the black soil during the hot months. Great numbers perish annually, when these collapse and fill up at the commencement of the rains.

"Their flesh is eaten by the tank-diggers. The female produces from 6 to 8 at a birth."

Sir W. Elliot also states that when the rainfall was deficient at the commencement of the season, the metad rats bred in such numbers as to become a perfect plague and to destroy the crops.

291. *Mus gleadowi*. *The sand-coloured Rat*.

Mus gleadowi, Murray, *P. Z. S.* 1885, p. 809, pl. li; *W. Sclater*, *P. Z. S.* 1890, p. 531.

Fur soft, without spines. Tail about the same length as the head and body, or shorter, not pencilled. Eyes large. Ears large, reaching the front of the eye when laid forward, thinly clad. Planta narrow, and bearing only four pads. Mammæ 6: 1 pair pectoral, 2 inguinal. Skull convex above, similar to that of *Mus mettadu*.

Colour above sandy (light greyish brown) or sometimes fawn, below and the feet white. Basal three fourths of dorsal fur dark leaden grey, terminal portion pale whitish brown, a few of the hairs tipped dark brown; no black hairs. Underfur of lower parts white. The short hair on the tail is light brown above, white below.

Dimensions in spirit: head and body 3·5 inches, tail 3, ear 0·63, hind foot 0·7; extreme length of skull 1.

Distribution. The types were from Karáchi, Sind. A fawn-coloured specimen in the British Museum was received from Kattiwar. There are other specimens in the Indian Museum from Cutch and from Goona, south of Gwalior.

292. *Mus erythrotis*. *The hairy-eared Mouse*.

Mus erythrotis, Blyth, *J. A. S. B.* xxiv, p. 721 (1855), xxxii, p. 448; *id.* *Cat.* p. 120; *W. Sclater*, *P. Z. S.* 1890, p. 529, pl. xlv, fig. 5 (skull).

Fur long, dense, soft. Tail longer than head and body, clad with hairs rather longer than usual, but no longer at the end of the tail than elsewhere. Ears small, round, hairy, almost concealed by the fur. Mammæ 8. Proximal plantar pad oval. In the skull the anterior border of the maxillary zygomatic process is straight and vertical, the zygoma itself slightly concave.

Colour "rich dark brown, grizzled and brightly tinged with rufous or rufo-ferruginous towards the tail and upon the ears conspicuously; lower parts albescent, tinged with fawn; feet with brown hairs upon their upper surface" (Blyth). Basal portion of hair above and below dark slate-colour.

Dimensions of an adult female in spirit: head and body 2·85 inches, tail 3·25, hind foot without claws 0·68, ear-conch 0·32; length of skull 0·8, greatest breadth 0·42.

Distribution. Cherra Poonjee in the Khási hills, and Manipur. *Mus pygmaeus* of A. Milne-Edwards from Moupin is perhaps the same.

293. *Mus humei*. *Hume's Rat*.

Mus humei, Thomas, *A. M. N. H.* (5) xvii, p. 84 (1886); *id.* *P. Z. S.* 1886, p. 63, pl. v.

Fur soft, without spines. Tail shorter than the head and body, more hairy than it usually is in *Mus*, but not pencilled at the end. Ears moderately large, rounded, thinly clad. Thumb the merest rudiment; 5th front toe very short, barely reaching the division between the 2nd and 3rd toes; 5th hind toe just reaching the base of the 4th. Mammæ 8: 2 pairs pectoral, 2 inguinal. Skull convex above, the nasals short, anterior border of maxillary zygomatic process concave below and with a salient angle above. Molars broad, the third as long as the second.

Colour above speckled brown, a mixture of black and isabelline, the anterior portions of the body greyish, the rump and between the thighs rich rufous; underparts pale rufescent or yellowish. Underfur both above and below leaden grey, blackish on the back, where most of the hairs have isabelline tips, but longer hairs are intermixed that are black throughout. Feet brown. Tail particoloured, the short hair black above, white below, but the scaly skin is brown.

Dimensions taken from skins: head and body 5 inches, tail 4.25, hind foot 1, ear 0.5; length of skull about 1.1, zygomatic breadth 0.6.

Distribution. The only locality yet known is Moirang, Manipur, where Mr. Hume obtained six specimens.

This species resembles *Golunda ellioti* in coloration and the form of the skull.

Genus *NESOCIA*, Gray (1842).

Syn. *Nesokia*, Gray; *Spalacomys*, Peters (1860).

Form robust; head short, rounded, muzzle short and broad; tail

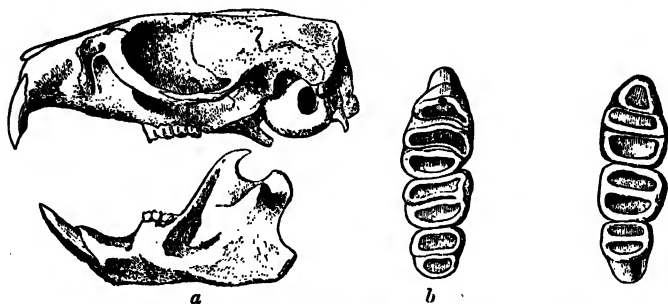


Fig. 133.—a. Skull of *N. bengalensis*, nat. size; b, upper, c, lower right molar, $\times 3$.

long, scaly, ringed, almost naked; ears rounded; feet broad, planta with six pads, the proximal pad elongate; all the toes except the rudimentary pollex with strong, nearly straight claws.

Incisors broader than in *Mus*, the anterior surface of the upper pair minutely sculptured with irregular longitudinal wrinkles. Molars composed of transverse laminae, straight or slightly curved, 3 in the first molar, 2 in the second and third in both jaws. Pterygoids very thin and high, pterygoid fossa deep. Infraorbital foramen typical; lower portion very narrow, the outer border slanting forward from the base (less in *N. hardwicki*), then broadly rounded and deeply sinuate. Anterior palatine foramina narrow. Fronto-parietal area narrow, bordered by strong lateral crests.

It is doubtful whether this should rank as more than a subgenus of *Mus*. Four species are found within Indian limits; the only other known forms are from Central Asia.

Synopsis of Indian, Ceylonese, and Burmese Species.

- a. Tail less than $\frac{3}{4}$ head and body; mammae 8 .. *N. hardwicki*, p. 422.
- b. Tail more than $\frac{3}{4}$ head and body.
 - a'. Smaller; hind foot 1"25-1"45; mammae 14-18 *N. bengalensis*, p. 423.
 - b'. Larger; hind foot 1"9; mammae 12 *N. nemorivaga*, p. 423.
 - c'. Still larger; hind foot 2"5; mammae 12 .. *N. bandicota*, p. 425.

294. *Nesokia hardwicki*. *The short-tailed Mole-Rat.*

? *Arvicola indica*, Gray & Hardw. *Ill. Ind. Zool.* i, pl. xi (1832) (no description, very bad figure); nec *Mus indicus*, Bechstein, nec *idem*, Geoffroy.

Mus hardwickii, Gray, *Charlesworth's Mag. N. H.* i, p. 585 (1837); *Blyth, J. A. S. B.* xxxiv, pt. 2, p. 193.

Nesokia hardwickii, Gray, *A. M. N. H.* x, p. 265 (1842); *Jerdon, Mam.* p. 190; *W. Selater, P. Z. S.* 1890, p. 522.

Mus pyctorhis, *Hodgson, A. M. N. H.* xv, p. 267 (1845).

Mus huttoni, *Blyth, J. A. S. B.* xv, p. 139 (1846).

Nesokia griffithii, *Horsfield, Cat.* p. 145 (1851).

Spalacomys indica, *Peters, Abhandl. Akad. Berl.* 1860, p. 143, pl. ii, fig. 1.

Nesokia indica, *Blyth, J. A. S. B.* xxxii, p. 328, partim.

Mus (Nesokia) indicus, *Blyth, Cat.* p. 112, partim.

Nesokia huttoni, *Blanford, Eastern Persia*, ii, p. 69, pl. vi, fig. 1.

Mus (Nesokia) hardwickii, *Anderson, J. A. S. B.* xlvii, pt. 2, p. 221; *Thomas, P. Z. S.* 1881, p. 524.

Mus (Nesokia) huttoni, *Anderson, ibid.* p. 223.

Fur varying in texture. Longer hairs on back not conspicuous. Tail half to two thirds the length of the head and body. Ears small. Feet very thinly clad above. Mammae 8 : 2 pairs inguinal, 2 pectoral. Skull short, muzzle especially so. Anterior palatine foramina very small, shorter than the crowns of the upper molars together. Incisors broad.

Colour above yellowish to rufous-brown, not dark, isabelline or hoary below. The basal two-thirds or more of all hairs, dorsal and ventral, dark leaden grey, terminal portion on back pale yellowish brown or rufescent, a few longer black-tipped hairs scattered over the lower back and rump.

Dimensions. Head and body 5.5 inches to 8.5, tail 3.5 to 5, ear outside 0.5, hind foot 1.25 to 1.5. The above dimensions in an average-sized male were 6.6, 4.4, 0.5, and 1.3. Basal length of skull 1.65, zygomatic breadth 1.15.

Distribution. North-western India (North-West Provinces, Rájputána, Sind, and the Punjab), Afghanistan and Baluchistan, up to 4000 or 5000 feet elevation. A specimen has been obtained as far east as Purneah, Bengal.

Varieties. *N. huttoni* is distinguished by softer fur, often bright rufous or yellowish brown in colour. The hind feet are longer, 1.4 to 1.5 inches without claws. This form is found at higher elevations in Baluchistan and Afghanistan.

Typical *N. hardwicki* has harsher fur and is duller and browner in colour, the hind foot measuring 1.2 to 1.3. This is found in N.W. India. The two pass into each other.

Habits. The short-tailed mole-rat is found both in cultivated and in waste ground. I have often seen their holes about irrigated wheat-fields, but usually drier situations are preferred. The burrows run irregularly, ramifying frequently, at a depth of 6 inches to 2 feet below the surface. In one series of burrows that I explored I found a nest lined with grass at a depth of 1½ to 2 feet, and I captured 4 *Nesokia*, 2 males and 2 females. The entrances to the burrows are covered by small heaps of earth, like mole-hills, thrown out by the rats. This animal feeds on grass, roots, and grain.

N. scullyi from near Yarkand, and *N. brachyura* from Lob-nor, are Central Asiatic forms allied to *N. hardwicki*.

295. *Nesokia bengalensis*. The Indian Mole-Rat.

Arvicola bengalensis, Gray & Hardw. *Ill. Ind. Zool.* ii, pl. 21 (1833-34).

Mus kok, Gray, *Charlesworth's Mag. N. II.* i, p. 585 (1837).

Mus (*Neotoma*) *providens*, Elliot, *Mad. Jour. L. S.* x, p. 209 (1839).

Nesokia hardwickii, Kelaart, *Prod.* p. 65, nec Gray.

Nesokia kok, Kelaart, *ibid.* p. 66.

Mus daccaensis, Tytler, *A. M. N. H.* (2) xiv, p. 173 (1854).

Mus tarayensis, plurimammis, and morungensis, Hodgson, Horsfield, *A. M. N. II.* (2) xvi, p. 112 (1855).

Nesokia indica, Blyth, *J. A. S. B.* xxxii, p. 328; Jerdon, *Mam.* p. 187; Theobald, *P. A. S. B.* 1866, p. 239; Blyth, *Mam. Birds Burma*, p. 38.

Mus (*Nesokia*) *indicus*, Blyth, *Cat.* p. 112, partim.

Mus (*Nesokia*) *blythianus*, barclayanus, and providens, Anderson, *J. A. S. B.* xlvii, pt. 2, pp. 225-231, pl. xiii.

Nesokia barclayana, Blanford, *Yark. Miss.*, *Mam.* p. 46, pl. x a, fig. 1 (skull).

Mus (*Nesokia*) *bengalensis*, Thomas, *P. Z. S.* 1881, p. 526; Anderson, *Fauna Mergui Archip.* i, p. 341.

Yenkrat, Beng.; *Kok*, Can.; *Golatta koku*, Tel. of Yanádis; ? *Rekywek*, Burmese.

Fur coarse, sometimes with long black-tipped piles throughout

the upper surface. Tail three quarters the length of the head and body or more. Mammary 7 to 9 pairs. Feet hairy above. Skull longer and muzzle narrower than in *N. hardwicki*; anterior palatine foramina longer than the crowns of all the upper molar teeth. Incisors and molars narrower.

Colour dark brown above, slightly grizzled with yellowish; below hoary grey to isabelline. Basal fur dark ashy or blackish throughout; tips of dorsal hairs brownish yellow or isabelline, and of the longer piles black.

Dimensions. Head and body 6 to 9 inches, tail 5·5 to 7·25, ear about 0·75, hind foot 1·2 to 1·45. A large Calcutta male measured 8·2, 6·45, 0·83, and 1·3. Basal length of skull 1·7, zygomatic breadth 1·1.

Distribution. The greater part of the Indian Peninsula from the base of the Himalayas to Cape Comorin, and from Lower Sind to Cachar and I believe Assam; more common in damp alluvial tracts, but ascending to the tops of the Nilgiris and other hills. Found also in Ceylon and in the valley of Kashmir, and apparently throughout Burma to the Mergui Archipelago.

Varieties. The form from Southern India, *N. kok* v. *providens*, is smaller, usually paler in colour, and the anterior palatine foramina are very narrow. The Bengal variety is larger, and the Burmese form is larger still.

Habits. An excellent account has been given by Elliot, but is too long for extraction. Several details have also been supplied by Jerdon and Anderson.

Nesocia bengalensis lives in cultivated plains, gardens, and pastures, where its presence may be recognized by the piles of earth, resembling large mole-hills, at each opening of its burrow. Often the openings are in the banks of ditches and tanks or the bunds of rice-fields. The burrows, as in the case of *N. hardwicki*, are extensive and of irregular form, often branching, sometimes circular, and leading to a central chamber or nest, in which much grain is occasionally stored by the rat, a pound being sometimes found in a burrow. Jerdon observed burrows occupying an area 15 to 20 yards in diameter. Elliot found only one occupant to each burrow. The food consists chiefly of grass and other roots, and of grain where that is procurable.

This mole-rat is somewhat fierce, and when irritated it erects its long piles and utters a grunting sound. It takes freely to water and swims well. From 8 to 10 young are said to be usually produced at each birth, but 14 have been observed by Sterndale in an individual kept by him, and which he succeeded in taming perfectly, so as to come when called by her name.

Elliot says that the Wadāris or tank-diggers of the Deccan, who eat all rats, capture this species in large numbers for food, and in some favourable localities are able, at particular seasons, to subsist on its hoards of grain.

296. *Nesocia bandicota*. The Bandicoot-Rat.

Mus bandicota and *indicus*, *Bechstein, Allgem. Uebers. d. vierfüß. Thiere*, ii, pp. 713, 714 (1800).

Mus malabaricus and *perchal*, *Shaw, Gen. Zool.* ii, pt. 1, pp. 54, 55 (1801).

Mus giganteus, *Hardwicke, Trans. L. S.* vii, p. 306, pl. 18 (1804); *Kelaart, Prod.* p. 58.

Mus (*Neotoma*) *giganteus*, *Elliot, Mad. Jour. L. S.* x, p. 209.

Mus bandicota, *Blyth, J. A. S. B.* xx, p. 167, xxxii, p. 333, partim; *id. Cat.* p. 112; *Jerdon, Mam.* p. 193, partim.

Mus (*Nesokia*) *giganteus*, *Anderson, J. A. S. B.* xvii, pt. 2, p. 232, pl. xiv, figs. a-d.

Mus (*Nesokia*) *bandicota*, *Thomas, P. Z. S.* 1881, p. 528.

Indúr, Sanscr.; *Ghous* or *Ghus*, H. and Mahr.; *Guru*, Kol.; *Heggin*, Can.; *Pandi koku*, Tel. of tank-diggers (pig-rat, whence the term bandicoot); *Ura-miyo*, Cing.

Size very large. Fur coarse, with long black-tipped piles, some of them often 2 or 3 inches long, on the upper parts. Ears moderate, rounded. Tail a little shorter than the head and body. Mammæ 12: 3 pairs pectoral, 3 pairs inguinal. Skull longer in proportion to the breadth than that of *N. bengalensis*; nasals broad and long, being about $\frac{2}{3}$ the length of the skull. Anterior palatine foramina as long as the row of upper molars or a little longer. Transverse laminae of molars not straight but slightly wavy.

Colour above blackish brown, sometimes grizzled with pale yellowish or grey, especially on the sides; lower parts greyish brown or brownish grey. Dorsal fur light greyish brown or ashy at the base, then (in some specimens) whitish, the longer hairs with long black terminations. In old animals whitish tips are mixed. Feet above dark brown.

Dimensions. Head and body 12 to 15 inches, tail 11 to 13, hind foot 2.5; weight $2\frac{1}{2}$ to 3 lbs. Basal length of a skull 2.6, zygomatic breadth 1.4.

Distribution. The Peninsula of India and Ceylon; not found in Lower Bengal, nor, I believe, in Sind or the Punjab; common in parts of Rajputana, and said to occur in the N.W. Provinces. Owing to large individuals of *M. decumanus* being mistaken for bandicoots, the present species has been incorrectly reported from several localities, Calcutta especially.

Habits. The bandicoot is, like other *Nesocia*, a burrower. It is found about cultivated tracts and is common in villages and towns, especially in the south of India. I believe it is also found in forest. It is very destructive to grain, on which it feeds largely; it also consumes fruit, vegetables, &c., and it is said occasionally to kill fowls. When it is attacked (and when running about at night according to McMaster), it grunts like a pig, hence its Telugu name. McMaster has shown that it is sluggish and cowardly, and killed by a dog more easily than would be anticipated from its size. Sterndale succeeded in taming one individual completely.

297. *Nesocia nemorivaga*.

♂ *Mus setifer*, Horsfield, *Res. Java* (1824); Cantor, *J. A. S. B.* xv, p. 254; Blyth, *J. A. S. B.* xxiv, p. 712, xxxii, p. 334.

Mus (*Rattus*) *nemorivagus*, Hodgson, *J. A. S. B.* v, p. 234 (1836); *id.* *A. M. N. H.* xv, p. 266 (1845).

♀ *Mus macropus*, Hodgson, *A. M. N. H.* xv, p. 268 (1845).

Mus bandicota, Blyth, *J. A. S. B.* xxxii, p. 333, partim; *id.* *Mam. Birds Burma*, p. 39; Jerdon, *Mam.* p. 193, partim, *nec Bechstein*.

Mus (*Nesokia*) *elliottanus*, Anderson, *J. A. S. B.* xlvii, pt. 2, p. 231, pl. xiv, figs. e-h (1878).

Mus (*Nesokia*) *nemorivagus*, Thomas, *P. Z. S.* 1881, p. 529.

♀ *Mye-kywek*, Burm.

Fur softer than in *N. bandicota*, the long piles less developed, and the underfur denser and finer. Proportions similar, but size smaller. Mammæ 12. Skull intermediate in form between those of *N. bandicota* and *N. bengalensis*; nasals about $\frac{1}{3}$ the length of the skull; anterior palatine foramina shorter than the upper molars together.

Colour. Dark brown above (black and brown mixed), paler or white brown below. Basal half of fur ash-grey both above and below, tips on back pale brown, those of the longer hairs dark brown or black. Feet above dark brown.

Dimensions. Head and body of an adult female in spirit 9 inches, tail 7·8, hind foot 1·9, length of ear 0·9; basal length of skull 2·1, zygomatic breadth 1·2.

Distribution. Bengal (Purneah, Calcutta, where it is rare), Eastern Himalayas, Assam (Sibsagar), and Khási hills; also Formosa. This species probably extends to Burma and the Malay countries.

Genus *ACOMYS*, Is. Geoffr. (1838).

Syn. *Acanthomys*, auct. *nec* Lesson.

Hinder part of the back covered with coarse, inflexible, flattened and grooved spines, without any hair intermixed. Mammæ 6: 1 pair axillar, 2 inguinal. Otherwise like *Mus*, from which the genus is doubtfully separable. Three or four species inhabit Western Asia and Northern Africa, and of these one has been found in Sind.

298. *Acomys dimidiatus*. *The pale spiny Mouse*.

Mus dimidiatus, Rüppell, *Atlas*, p. 37, pl. 13, fig. a (1826); Wagner, *Schreb. Säugeth. Supp.* iii, p. 440.

Sides, limbs, head, and lower parts covered with coarse hair. Tail about equal to the head and body in length, coarsely ringed, with short hair. Ears large, rounded. Feet short; planta coarsely granular near the toes, pads indistinct. Vibrissæ numerous.

Skull elongate. The mesopterygoid fossa opens about halfway between the molars and the bullæ; pterygoids short, meeting

anteriorly in an acute angle, diverging behind. Anterior palatine foramina very long, extending back to opposite the middle of the first molar. Molars broad and short, the first without an additional cusp.

Colour above sandy (very pale yellowish or rufescent brown), below white. No dark underfur. Vibrissæ white, except some of the uppermost.

Dimensions. Head and body 4 inches, tail 4, ear from crown 0.5, hind foot 0.75; length of skull 1.1.

Distribution. Egypt, Northern Arabia, and Palestine. A single specimen was obtained in Sind, at Laki, near Sehwan, by Mr. H. E. Watson.

Genus **GOLUNDA**, Gray (1837).

Syn. *Pelomys*, Peters (1852).

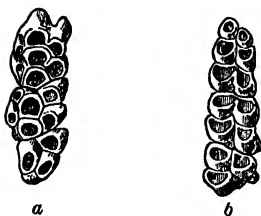


Fig. 134.—Upper (a) and lower (b) right molars of *G. ellioti*, $\times 3$.

Head short and rounded. Ears rounded, tail hairy. Feet as in *Mus*. Molars low, broad, tubercular in the young, the worn surface exhibiting a peculiar pattern composed of semi-circular lobes arranged in a triple row in the upper, and a double in the lower jaw. Upper incisors grooved. Bony palate narrow.

This genus occurs in Africa and India, one species being found in each area.

299. *Golunda ellioti*. *The Indian Bush-Rat*.

Golunda ellioti, Gray, *Charlesworth's Mag. N. H.* i, p. 586 (1837);

Kelaart, Prod. p. 67; *Blyth, J. A. S. B.* xx, p. 167, xxxii, p. 350;

id. Cat. p. 121; *Kelaart, Prod.* p. 67; *Jerdon, Mam.* p. 212;

Blanford, J. A. S. B. xlv, pt. 2, p. 165, xlv, pt. 2, p. 292.

Mus golundi and *M. hirsutus*, *Elliot, Mad. Jour. L. S.* x, pp. 208, 213 (1829).

Mus myothrix, *Hodgson, A. M. N. H.* xv, p. 267 (1845).

Golunda newera, *Kelaart, P. Z. S.* 1850, p. 158; *id. Prod.* p. 67;

Blyth, J. A. S. B. xxxii, p. 352.

Golunda coffæus, *Kelaart, Blyth, J. A. S. B.* xxxii, p. 351.

Pelomys watsoni, *Blanford, P. A. S. B.* 1876, p. 181.

Gulandi, Can.; *Utu-elli*, Tam.; *Coffee-watte-meyo*, Cing.

Fur coarse, the longer piles much flattened and broadly grooved, but not spiny. Feet small, well clad above; 5 pads on fore foot, 6 on hind. Ears moderate, round, thinly clad with short hair. Tail stout at the base and tapering, shorter than the head and body, and thinly clad throughout with coarse hairs, short but much

longer than in *Mus* generally. Mammæ 8 : 2 pairs pectoral, 2 inguinal. Skull longitudinally convex above, with well-marked temporal crests. Anterior palatine foramina very long.

Colour above yellowish brown, not uniform, but finely speckled black and fulvous; below brownish white or grey. Basal half to three quarters of dorsal fur ashy grey to leaden black, the coarse hairs paler than the fine short underfur; most of the longer and coarser hairs have whitish-brown or brownish-yellow terminations, but the tips of the longest hairs mixed with the others are black throughout. Tail dark brown above, pale below.

Dimensions of an adult female: head and body 4.55 inches, tail 4.1, ear 0.57, hind foot 0.85; basal length of skull 1.1, zygomatic breadth 0.55.

Distribution. Throughout the greater part of the Indian Peninsula and Ceylon. Recorded from Sind, Dagshai, Umballa, Satpura Hills, and many parts of the Bombay and Madras Presidencies. I feel some doubt about the Nepalese locality assigned to *Mus myothrix*. *G. ellioti* has not been observed in Bengal.

Habits. According to Sir W. Elliot, the guliandi lives entirely in the jungle, choosing its habitation in a thick bush, among the thorny branches of which, or on the ground, it constructs a nest of elastic stalks and fibres of dry grass, thickly interwoven. The nest is of a round or oblong shape, from 6 to 9 inches in diameter, and encloses a chamber about 3 or 4 inches across. The motions of this animal are somewhat slow, and it does not appear to have the same power of springing or leaping as other rats. Its food seems to be vegetable, the only contents of the stomach observed being roots of the dūb or hariyāli grass (*Cynodon dactylon*). Its habits are solitary (except when the female is bringing up her young) and diurnal, feeding in the mornings and evenings.

In Ceylon this rat has proved very destructive to coffee-trees, on the buds and blossoms of which it feeds. It appears, according to Kelaart, to migrate at times.

Subfamily CRICETINÆ.

Both lower and upper molars exhibiting biserial longitudinal structure, either rooted, with the tubercles on the crown in two longitudinal rows, or rootless, composed of subtriangular prisms arranged in a double line. Tail hairy and in all Indian species very short, less than half the length of the body.

To this subfamily belong the voles, hamsters, and some allied forms. The three genera represented within Indian limits are usually placed in three distinct subfamilies, *Arvicolinæ*, *Siphneinæ*, and *Cricetinæ*. All are Palearctic, and the first and third Nearctic also. Within our area these rodents are confined to the Himalayas and Afghanistan. The genera may be thus recognized:—

- A. Molars rootless, elongate, composed of prisms.
 a. Ear-conch present MICROTUS.
 b. Ear-conch wanting ELLOBIUS.
 B. Molars rooted, tubercular CRICETUS.

Genus **MICROTUS**, Schrank (1798).

Syn. *Arvicola*, Lacépède (1801); *Hypudæus*, Illiger (1811); *Neodon*, Hodgson (1849); *Phaiomys*, Blyth (1863).

Head short, rounded; ears, tail, and limbs short. Fur soft and thick. The thumb (pollex) is short and sometimes clawless, more often it bears a short compressed claw. Nasal portion of skull short; brain-case oval, broad, and depressed; infraorbital foramen of the typical murine form; anterior palatine foramina long; interparietal large, pointed in the middle anteriorly; auditory bullæ moderately large. Incisors orange or yellow, flat in front; molars rootless, formed of subtriangular prisms biserially arranged, with sharp salient angles on each side, the number varying in the different species. The last upper and first lower molars vary more than the others.

The genus is Palearctic and Nearctic, several species inhabiting the higher Himalayas. Of these I published a detailed account in 1881 (J. A. S. B. l, pt. 2, p. 88). From that account the following descriptions are abridged.

Synopsis of Indian and Burmese Species.

- A. Thumb of fore foot clawless.
 a. Colour light ferruginous brown *M. stoliczkanus*, p. 430.
 b. Colour light brown, with a grey tinge.. *M. stracheyi*, p. 431.
 B. Thumb with a small claw.
 a. Ears not projecting beyond the fur.
 a'. Colour dark rich brown above, light brown below..... *M. wynnæi*, p. 431.
 b'. Colour rufescent brown, lower parts light brown *M. roylei*, p. 430.
 c'. Colour earthy brown, lower parts whitish *M. blythi*, p. 432.
 b. Ears projecting beyond the fur.
 a'. Colour light greyish rufescent brown; tail $\frac{1}{2}$ head and body *M. blanfordi*, p. 432.
 b'. Colour dark yellowish brown; tail $\frac{1}{2}$ head and body
 a''. Ear from orifice 0.5 in.; anterior lower molar with 6 internal angles *M. sikimensis*, p. 433.
 b''. Ear from orifice 0.35 in.; anterior lower molar with 5 internal angles *M. melanogaster*, p. 434.

Of these species, *M. blythi*, *M. sikimensis*, and *M. melanogaster* differ from all the others in the form of the molar teeth, and the two last named differ greatly from *M. blythi*. In the remaining five species the posterior upper molar terminates behind in a

elongate lobe. For these species I proposed, in 1881, a subgeneric name *Alticola*. *M. sikimensis* and *M. melanogaster* belong to the subgenus *Neodon*.

300. *Microtus roylei*. *Royle's Vole*.

Arvicola roylei, Gray, *A. M. N. H.* x, p. 265 (1842); ? *Blyth, Cat.* p. 125; ? *Jerdon, Mam.* p. 216; *Blanford, J. A. S. B.* 1, pt. 2, p. 102 (1881).

Ears hairy, not projecting beyond the fur. Thumb with a claw. Tail nearly cylindrical, about one third the length of the head and body and covered with short hair. Last upper molar with 3 inner and 3 outer angles and terminating in an elongate lobe; first lower molar with 4 external and 5 internal angles.

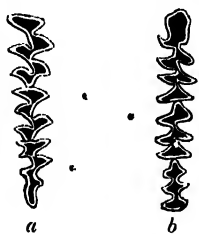


Fig. 135.—Crown of (a) upper and (b) lower molars of *M. roylei*, $\times 4$.

Colour rufous-brown on back, becoming yellower and paler on the sides and pale brown below; tail coloured like the back above, pale beneath. Basal half to two thirds of the fur leaden black, above and below; terminal portion on back light brown, becoming darker at the end, a few black tips intermixed.

Dimensions of dried skin: head and body 3 inches, tail without hair (vertebrae preserved) 1.1, hind foot 0.8.

Distribution. The type was from Kashmir. Jerdon observed voles on the Pir Panjal pass, also on the south side of Barendo pass N.E. of Simla, and near Chini, in Kunawar, at 12,000 feet elevation, but it is improbable that all belonged to the present species. The locality Pind Dadun Khan, given in Blyth's Catalogue, is a mistake. What Adams took for *Arvicola* in the Punjab Salt Range ('Wanderings of a Naturalist in India,' p. 152) remains to be ascertained.

Habits unknown. Jerdon found the Barendo pass species in large numbers, burrowing close to the surface in a meadow, and several were caught in digging a light trench round the tent.

301. *Microtus stoliczkanus*. *Stoliczka's Vole*.

Arvicola stoliczkanus, *Blanford, J. A. S. B.* xlv, pt. 2, p. 107 (1875); 1, pt. 2, p. 97; *id. Yark. Miss., Mam.* p. 42, pl. viii, fig. 1, pl. x b, fig. 2.

Ears small, completely concealed by the fur, hairy. Thumb rudimentary and clawless. Tail short, about a quarter of the head and body in length, covered with stiff hairs that extend half an inch beyond the end. Last upper molar with 2 strong inner and 4 weak outer angles, two close together near the front end of

the tooth, two also near together farther back on an elongate posterior lobe. First lower molar with 5 angles on each side, the anterior pair very small and blunt.

Colour above bright ferruginous brown, below pure white. Tail and feet white. Basal half to three quarters of the fur leaden black; terminal portion on the back rufous-white, tipped darker rufous, numerous rather longer dark rufous-brown tips intermixed.

Dimensions of dried skins: head and body 4 inches, tail without hair 1, hind foot with claws 0·7; length of skull about 1·15.

Distribution. Plateaus of Northern Ladak. One specimen obtained in the Nubra valley, and one at Aktagh on the Upper Yarkand River.

302. *Microtus stracheyi*. *The Kumaon Vole*.

Cricetus songarus, *Horsfield, Cat.* p. 145, nec *Pallas*.

Arvicola stracheyi, *Thomas, A. M. N. II.* (5) vi, p. 322 (1880); *Blanford, J. A. S. B.* 1, pt. 2, p. 98.

Ears small, hairy, not extending beyond the fur. Thumb rudimentary and clawless. Tail short, about one fifth the length of the head and body, covered with short hair, the tip with longer, extending half an inch beyond the end. Last upper molar with 2 strong internal and 4 weak external angles, the latter in pairs, the posterior pair on the long narrow posterior lobe. First lower molar with 5 internal and 5 external angles, the anterior on each side ill-marked.

Colour above rather light brown, below white, tail nearly white. Base of fur blackish grey throughout, with, on the back, in the only specimen examined, a whitish ring in the middle of the dark portion (this may be an individual peculiarity); terminal portion of dorsal hairs whitish, becoming brown at the tips. Some black ends intermixed.

Dimensions of a dried skin: head and body 3·7 inches, tail without hair 0·7, hind foot 0·65.

Distribution. Kumaun. A specimen from Dharmsála is also referred to this species by Mr. W. Slater.

303. *Microtus wynnei*. *The Murree Vole*.

Arvicola wynnei, *Blanford, J. A. S. B.* xlix, pt. 2, p. 244 (1880); 1, pt. 2, p. 99.

Kanis, H.

Ears hairy, not extending beyond the fur. Thumb with a short claw. Tail $\frac{1}{3}$ to $\frac{1}{4}$ the length of the head and body, clothed with long hair at the base, and with short elsewhere. Hinder upper molar with 2 inner and 3 outer angles, the posterior outer angle ill marked, the tooth ends in a long narrow lobe. First lower molar with 5 inner and 4 outer angles.

Colour above varying from dark rich brown with a slight greyish tinge to dark chestnut, lower parts pale brown, tail coloured like the back. Base of fur leaden black throughout.

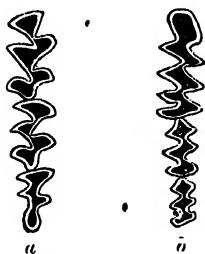


Fig. 136.—Crowns of (a) upper and (b) lower molars of *M. wynnii*, $\times 4$.

Dimensions of a male in spirit: head and body 4·75 inches, tail 1·35, ear 0·25, hind foot 0·7; extreme length of skull 1·14, zygomatic breadth 0·75. Another male measures only 3 inches from nose to rump, tail 1·2.

Distribution. Murree, obtained by Mr. Wynne in the station.

A specimen with similar dentition to *M. wynnii*, but brown (not rufous) above, whitish below, with ears projecting considerably beyond the fur, was received without trustworthy locality, but associated with Kashmir specimens, at the British Museum.

304. *Microtus blanfordi*. *The Gilgit Vole*.

Arvicola blanfordi, Scully, *A. M. N. II.* (5) vi, p. 399 (1880); *id.* *P. Z. S.* 1881, p. 206; *Blanford, J. A. S. B.* 1, pt. 2, p. 104.

Ears projecting beyond the fur, rounded, covered with short hair. Thumb very small, but with a small claw. Tail nearly half the length of the head and body, well clad with short hair. Hinder upper molar with 3 inner and 3 outer angles and terminating in a short longitudinal lobe. First lower molar with 5 inner and 4 outer angles.

Colour greyish brown above, white below; tail light brown above, sullied white beneath. Base of fur leaden black throughout, terminations on back pale brown, the tips darker, some longer black tips intermixed, especially on the rump.

Dimensions of a male fresh: head and body 4·55, tail 2·05, ear 0·7, hind foot 0·75.

Distribution. Gilgit, 9000 to 10,000 feet.

305. *Microtus blythi*. *Blyth's Vole*.

Phaiomys leucurus, Blyth, *J. A. S. B.* xxxii, p. 89 (1868); *id.* *Cat* p. 125; *Theobald, J. A. S. B.* xxxi, p. 519; *Stoliczka, J. A. S. B.* xxxiv, p. 110, nec *Arvicola leucurus*, Gerbe (1862).

Arvicola blythi, Blandford, *J. A. S. B.* xlv, pt. 2, p. 107 (1875) 1, pt. 2, p. 106; *id.* *Yark. Miss., Mam.* p. 39, pl. viii, fig. 2, pl. x & fig. 1.

Phise, Ladak.

Ears hairy, not extending beyond the fur. Thumb with a short claw. Tail $\frac{1}{4}$ to $\frac{1}{3}$ the length of the head and body, covered with short hair. Last upper molar with 3 internal and 3 external

angles and without any narrow posterior lobe. First lower molar with 5 inner and 4 outer angles, third with 3 inner but only 2 outer angles, other species having 3.

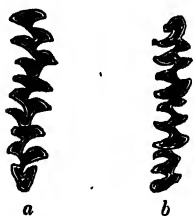


Fig. 137.—Crowns of (a) upper and (b) lower teeth of *M. blythi*. $\times 4$.

Colour above earthy brown, not dark (yellowish brown with a greyish tinge); below brownish white; tail light brown. Base of fur above and below dark ashy grey, terminations on back grey-brown, with dark brown or black ends intermixed.

Dimensions of a fresh specimen: head and body 4 inches, tail, 1.35; of another, a large female, 4.9 and 1.25. A skull is 1.03 in extreme length, and 0.67 in zygomatic breadth.

Distribution. Banks of Tsho Morari and Pankong lakes, Western Tibet, also between Leh and the Pankong lake at elevations above 13,000 feet. According to Stoliczka this vole is also found in Spiti, Lahul, and Kulu.

Habits. This vole was found by Mr. Theobald to make deep



Fig. 138.—*Microtus blythi*.

burrows on the banks of the Tsomoriri. In a female he found 6 young.

Two species of vole, *M. mandarinus* and *M. guentheri* (the former related to *M. blythi*), have been obtained in Afghanistan.

306. *Microtus sikimensis*. *The Sikkim Vole*.

Neodon sikimensis, Hodgson, *Horsfield, A. M. N. H.* (2) iii, p. 203 (1849) (no description); *id. Cat.* p. 146; *Blyth, Cat.* p. 125; *Jerdon, Mam.* p. 217; *Blanford, Yark. Miss., Mam.* p. 41; *id. J. A. S. B.* 1, pt. 2, p. 110.

Arvicola thricolis (thricotis), Hodgson, *Cat. Mam. &c., Nepal & Tibet*, B. M. 2nd ed. 1863, p. 10 (no description).

Phalchua, Nepalese; *Chik yu*, Karanti; *Sing phuchi*, Tibetan.

Ears thinly clad, projecting beyond the fur, which is of moderate

length. Whiskers moderate. Tail thinly clad, tapering, one third the length of the head and body, or rather more. Mammaræ 8: 2 pairs pectoral, 2 inguinal. Last upper molar with 4 internal and 3 external angles; no posterior lobe. First lower molar with 6 inner and 5 outer angles.



Fig. 139.—Crowns of (a) upper and (b) lower molars of *M. sikimensis*, $\times 4$.

Colour dark brown, with a yellowish tinge above, below pale brown. Base of fur leaden black above, dark ashy below, tips on back light brown mixed with numerous black ends.

Dimensions of a fresh specimen: head and body 4.75 inches, tail 1.75, hind foot 0.75. In a female in spirit the ear from the orifice measures 0.5.

Distribution. Sikhim, between 7000 and 10,000 feet elevation.

Habits. This vole inhabits forests and, according to Hodgson, breeds in hollow decayed trees or amongst the roots of trees, making a nest of moss or soft grass. The female has 3 or 4 young at a time.

307. *Microtus melanogaster*. Père David's Vole.

Arvicola melanogaster, *M.-Edw. Nouv. Arch. Mus.* vii, *Bull.* p. 93 (1871); *id. Rech. Mam.* p. 284, pls. xliv, xlv i a; *Blanford, J. A. S. B.* 1, pt. 2, p. 114.

Ears thinly clad, shorter than in *M. sikimensis*, projecting beyond the fur by one third of their length. Feet small. Last upper molar with 3 or 4 angles on each side, usually 3 well-marked and a fourth weak external angle on the U-shaped posterior termination of the tooth. Anterior lower molar with 5 external and 5 or 6 internal angles, the angles inside and outside sometimes nearly opposite to each other, not alternating.

Colour as in *M. sikimensis*. Some specimens are more rufous.

Dimensions of a male in spirit: head and body 3.7 inches, ear from orifice 0.37, tail 1.4, hind foot 0.6 (in a Bhámo specimen 3, 0.3, 1.4, and 0.65).

Distribution. South-western China (Fokien, Sechuen) and Moupin in Eastern Tibet. Mr. Thomas has identified this species amongst Mr. Fea's collections from the Kakhyen hills, near Bhámo.

Genus *ELLOBIUS*, Fischer (1814).

Syn. *Myospalax*, Blyth, 1846, nec Brandt, 1855.

No distinct ear-conch. Head very blunt and rounded. Body subcylindrical, feet broad. Claws 5—5, straight, compressed.

Tail very short, hairy. Skull very different from that of *Microtus*, the facial portion, zygomatic arches, and occipital crest being much more developed, and the brain-case rounded, not depressed, conoidal not oval in front, and with the occipital surface sloping backwards from above. Infraorbital foramen subtriangular, less narrowed below than in *Microtus*. Anterior palatine foramina very small, nearer to the molars than to the incisors; palate between molars hollowed out on each side. Bullæ small, depressed. Incisors white, protruding greatly forwards. Molars similar to those of *Microtus*.

One species occurs in Afghanistan, extending to Quetta. The only other clearly known form, *E. talpinus*, inhabits Central and Western Asia and Eastern Europe. *E. intermedius*, lately described by Scully from near Herat (J. A. S. B. lvi, pt. 2, p. 73), is referred to *E. talpinus* by Büchner (Mam. Przewalsk. p. 137) and to *E. fuscicapillus* by Thomas, with whom I agree. It is possible, as Büchner suggests, that *E. fuscicapillus* may be only a variety of *E. talpinus*, but the cranial distinctions are considerable.

308. *Ellobius fuscicapillus*. The Quetta Vole.

Georchus fuscicapillus, Blyth, J. A. S. B. x, p. 928 (1841) (no description), xi, p. 887 (1842).

Myospalax fuscicapillus, Blyth, J. A. S. B. xv, p. 141; *id.* Cat. p. 120.

Ellobius fuscicapillus, Blanford, J. A. S. B. l, pt. 2, p. 119; O. Thomas, Tr. L. S. (2), Zool. v, p. 59.

Fur soft and long. Tail very short, thinly clad with moderately long hair. Six pads on each hind foot, all elongate. In the



Fig. 140.—Crowns of (a) upper and (b) lower molars of *E. fuscicapillus*, $\times 4$.

zygomatic arch the malar does not extend to the lower edge, where the maxillary and squamosal processes meet. The first and second upper molars have each 3 inner and 3 outer angles, the third 2 inner and 3 outer and the tooth is but little shorter than the second. The first lower molar has 5 inner and 4 outer angles (the anterior angle on each side ill-developed), the second and third 3 on each side.

Colour pale rufescent sandy (brownish white) above, except the head, which is dark greyish brown. Lower parts, feet, and tail white. Basal three quarters or

more of the fur above and below dark leaden grey. No black-tipped hairs on the back.

Dimensions. An adult female in spirit measures: head and body 4.7 inches, tail 0.5, hind foot 0.8; basal length of skull 1.3, zygomatic breadth 1.

Distribution. Originally obtained by Hutton at an elevation of

5500 feet around Quetta, where, however, it has not since been found. Specimens were brought by Dr. Aitchison from Northern Afghanistan.

Habits. This mole-like rodent was said by Hutton to shake long horizontal galleries, marked by earth-heaps thrown out at intervals.

Genus **CRICETUS**, Cuv. (1800).

Internal cheek-pouches present. Form stout, head blunt; tail short, not scaly, sparsely haired. Incisors not grooved. Molars in both jaws with the tubercles arranged longitudinally in pairs, 3 pairs in the anterior molar, 2 in the second and third. The tubercles are worn down in old animals. Vertebra: C. 7, D. 13, L. 6, S. 3, C. 17.

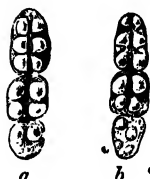


Fig. 141.—Crowns of (a) upper and (b) lower molars of *C. phæus*, $\times 5$.

The hamsters are Palearctic, but Thomas and others have shown (P. Z. S. 1888, p. 133) that the American genus *Hesperomys* must be united. The grey Central Asiatic forms, distinguished by A. Milne-Edwards as *Cricetulus*, have three representatives in Gilgit, but have hitherto not been found elsewhere within our limits.

Synopsis of Indian Species.

- | | | |
|--|-------|---------------------------------|
| A. Head and body $3\frac{1}{2}$ to 4" long | | <i>C. phæus</i> , p. 436. |
| B. Head and body about 4" to 5" long | | <i>C. fulvus</i> , p. 437. |
| C. Head and body about 5" to 6" long | | <i>C. isabellinus</i> , p. 437. |

309. *Cricetus phæus*. *The little grey Hamster.*

Mus phæus, Pallas, *Glires*, pp. 86, 261, pl. xva (1784).

Cricetus (*Cricetulus*) *phæus*, Blanford, *Yark. Mus.*, *Mam.* p. 44; *id.*

J. A. S. B. xlviii, pt. 2, p. 96; Scully, *P. Z. S.* 1881, p. 205.

Tail cylindrical, about one fourth the head and body in length. Feet short. Planta hairy, with 6 tubercles, all on the distal half. Ears rounded, thinly clad. Fur soft.

Colour ashy grey above, sometimes with a fulvous tinge, the back with a blackish wash. Lower parts white. Basal two-thirds of dorsal fur leaden black, tips of some hairs blackish.

Dimensions. Head and body 3.7 inches, tail 1, ear 0.75, hind foot 0.6; basal length of skull 0.95, zygomatic breadth 0.5.

Distribution. Widely spread in Central Asia; common in Persia, Turkestan, &c. Found in Gilgit by Biddulph and Scully from 5000 to 9000 feet elevation.

Habits. This hamster frequents cultivated lands and pastures and is frequently found in houses.

310. *Cricetus fulvus*. *The fulvous-grey Hamster.*

Cricetus (*Cricetulus*) *fulvus*, *Blanford, J. A. S. B.* xliv, pt. 2, p. 108 (1875), xlviii, pt. 2, p. 96; *id. Yark. Miss., Mam.* p. 45, pl. ix, fig. 1, pl. x b, fig. 3; *Scully, P. Z. S.* 1881, p. 205.

Precisely similar to the last in structure but larger.

Colour fulvous grey above, white below. More rufous or isabelline than *C. phæus*, but otherwise similar.

Dimensions. Head and body about 4·5 inches, tail 1·45, ear 0·6, hind foot 0·7; skull 1·17 long (total length), 0·64 broad.

Distribution. Káshghar, Yárkand, and the Pámir, extending to Gilgit, where it occurs with the last.

311. *Cricetus isabellinus*. *The large grey Hamster.*

Cricetus isabellinus, *De Filippi, Viaggio in Persia*, p. 344; *Scully, P. Z. S.* 1881, p. 205.

Precisely similar to *C. phæus* but much larger.

Colour greyish isabelline above, white below.

Dimensions. Head and body 5·35 inches, tail 1·1.

Distribution. Found by De Filippi at Tehrán, Northern Persia, and by Scully in Gilgit.

It is somewhat doubtful whether these three forms of *Cricetus* should be considered species or only varieties. *C. fulvus* is about double and *C. isabellinus* fully quadruple the weight of *C. phæus*. The different forms occur in several places, but this is not in favour of their being distinct.

Family SPALACIDÆ.

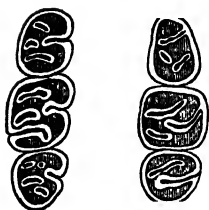


Fig. 142.—Crowns of (a) upper and (b) lower molars of *Rhizomys pruinosus*, × 2.

The *Spalacidae* are sometimes called rodent moles, and resemble a mole in general aspect, having cylindrical bodies, short limbs, small eyes and ears, large claws, and a short or rudimentary tail. The infra-orbital opening is small or moderate, with no perpendicular plate; and the palate is narrow. The incisors are large, the molars rooted, with re-entering enamel folds.

A single genus, *Rhizomys*, inhabits South-eastern Asia and occurs in the Himalayas and Burma: other members of the family are Palearctic or Ethiopian.

Genus **RHIZOMYS**, Gray, 1831.Syn. *Nyctocleptes*, Temm.

Form robust; eyes very small; ears small and naked; thumb very small, rudimentary, but furnished with a claw. Tail almost naked, having only a few scattered hairs, and not scaly, about one fourth to one third the length of the head and body.

Dentition: i. $\frac{2}{2}$ m. $\frac{3-3}{3-3}$. The upper incisors are arched forward and both they and the lower incisors are usually deep orange in colour; occasionally, however, the upper incisors are white, the lower orange. There are no premolars. Vertebrae: C. 7, D. 13, L. 2, S. 4, C. 19 (in *R. badius*). There are 3 pairs of inguinal and 2 pairs of pectoral mammae. The anatomy has been described by Anderson (*An. Zool. Res.* p. 314).

Three distinct forms occur within our limits. Remains of a fossil species have been found in the Siwalik beds.

Synopsis of Indian and Burmese species.

- A. Head and body 7 to 8 inches; colour chestnut or dark brown, not grizzled *R. badius*, p. 438.
- B. Head and body 10 to 14 inches; colour dark brown, grizzled *R. pruinus*, p. 439.
- C. Head and body 15 to 19 inches; colour dark ashy to light brown *R. sumatrensis*, p. 439.

312. *Rhizomys badius*. The bay Bamboo-Rat.

Rhizomys badius, Hodgson, *Calc. Journ. N. H.* ii, pp. 60, 410 (1842); Blyth, *J. A. S. B.* xii, p. 925; *id. Cat.* p. 122; Jerdon, *Mam.* p. 214; Anderson, *An. Zool. Res.* p. 329, pls. xiv, xvi; Thomas, *F. Z. S.* 1886, p. 65.

Rhizomys minor, Gray, *A. M. N. H.* x, p. 266 (1842); Horsf. *Cat.* p. 165; Blyth, *Mam. Birds Burma*, p. 41; Anderson, *An. Zool. Res.* p. 327, pls. xv, xvi.

Rhizomys castaneus, Blyth, *J. A. S. B.* xii, p. 1007 (1843); *id. Cat.* p. 123; *id. Mam. Birds Burma*, p. 41; Blanford, *J. A. S. B.* xlvii, pt. 2, p. 165.

Yukron, Kakhyen; Khai, Burmese.

Fur soft and rather thick. Ears hidden by the fur. Foot-pads smooth, not tuberculated.

Colour chestnut, bay or ashy brown, but nearly uniform in each individual, rather brighter and deeper above than below. All the basal portion of the fur, two thirds to three fourths or more, dark cinerous or leaden grey. Sometimes there is a white spot on the forehead. In most young specimens and some adults the tips of the hairs are dull rufous or ashy brown (*R. minor*).

Dimensions. Head and body 7 to 9 inches, tail about 2.7, hind foot from heel 1.3, Both sexes the same; basal length of skull 1.85,

zygomatic breadth 1.45. Some skulls appear smaller, one apparently adult measures 1.75 by 1.3.

Distribution. The base of the Eastern Himalayas in Nepal, Sikkim, and Bhutan; Assam, Manipur, and throughout Burma, also north of Burma in the hill-ranges near Bhámo, and in Siam.

Habits. This animal lives in burrows made by itself, sometimes, it is said, under roots of trees, elsewhere, as observed by Anderson, in high rank grass. It leaves its burrow in the evening and feeds on various vegetables, especially young shoots of grasses and cereals, and probably of bamboo. It is also said to feed largely on roots; indeed, Hodgson's view, from observations on a living animal, was that these were the principal object of its burrows. It burrows rapidly, using its powerful teeth as well as its claws in the process. Above ground the pace of *Rhizomys* is slow; the animal appears fearless, so much so that wild individuals are said to allow themselves to be captured without resisting, though ready enough to turn upon an assailant.

This and other species are eaten by many of the Burmese hill tribes.

313. *Rhizomys pruinusos.* *The hoary Bamboo-Rat.*

Rhizomys pruinusos, *Blyth, J. A. S. B.* xx, p. 519; *id. Cat.* p. 122; *id. Mam. Birds Burma*, p. 41; *Anderson, An. Zool. Res.* p. 325, pls. xiii, xvi.

Fur soft and thick, concealing the small ears. Foot-pads covered with tubercles.

Colour dark brown throughout, with a hoary or grizzled appearance owing to scattered whitish hairs, which are shorter, finer, and closer together on the lower surface, giving a somewhat silvery tone. Basal half of dorsal fur dark ashy, paler on the head. In old females the sides of the head, muzzle, and chin are pale brown.

Dimensions of a large male: head and body 13 inches, tail 4, hind foot from heel 2.2. In a smaller individual, a female, the corresponding measurements are 10.75, 3.75, and 1.95. Basal length of a skull 2.6, zygomatic breadth 2.

Distribution. Khási and other hills south of Assam, extending to the Kakhyen hills north of Upper Burma and to Karennee. There is also in the British Museum a skull from Cambodia and another from Swatow, China.

Habits. So far as known, similar to those of *R. badius*. The female produces three or four at a birth.

314. *Rhizomys sumatrensis.* *The large Bamboo-Rat.*

Mus sumatrensis, *Raffles, Tr. Linn. Soc.* xiii, p. 258 (1822).

Rhizomys sumatrensis, *Gray, P. Z. S.* 1831, p. 95; *Cantor, J. A. S. B.* xv, p. 255; *Blyth, J. A. S. B.* xxviii, p. 294; *id. Cat.* p. 122; *id. Mam. Birds Burma*, p. 41; *Anderson, An. Zool. Res.* p. 322.

Rhizomys cinereus, *McClelland, Calc. Jour. N. H.* ji, p. 456; *Blyth, J. A. S. B.* x, p. 920.

Rhizomys erythrogenys, Anderson, P. A. S. B. 1877, p. 150; *id. An. Zool. Res.* p. 324, pl. xiii a.

Pwe, Burmese; *Tikus bulo*, Malay

Fur short and thin, with numerous coarse whitish hairs scattered through it on the back. Foot-pads covered with flattish tubercles. Skull thick and massive, muzzle broad.

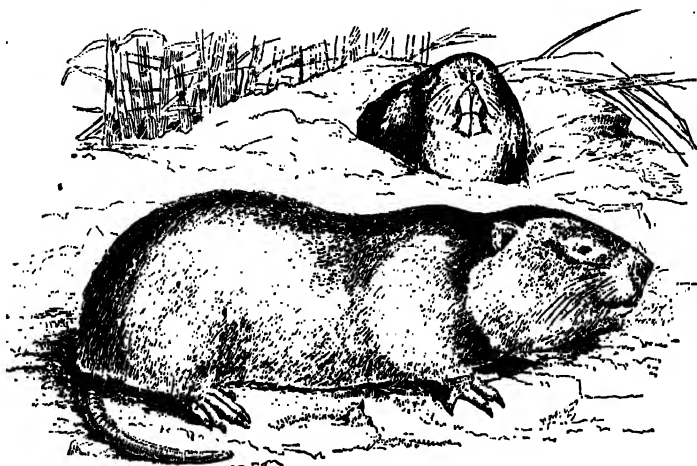


Fig. 143.—*Rhizomys sumatrensis* (after Anderson).

Colour varying from dark ashy grey or greyish brown to light brown or brownish buff or isabelline, the middle of the back darker and the lower parts paler. Sides of the head pale, or sometimes bright ferruginous red. There is occasionally a white frontal spot. The bright ferruginous coloration of the cheeks, from which the name *erythrogenys* was derived, and the dark ashy tint of the back are, according to Cantor, signs of immaturity.

Dimensions. Head and body in a large male 19 inches, tail $5\frac{1}{2}$. Other specimens 15 to 17 inches, tail 5 to 6. A skull measures 3.15 in basal length, 2.5 in zygomatic breadth.

Distribution. The Malay Peninsula and Siam, extending throughout the Tenasserim Provinces as far north as Moulmein, Shwegyeng, and Karennee.

Habits. Like the other species of the genus, this is doubtless a burrower, but scarcely anything appears recorded of its habits in the wild state.

The only Asiatic species not found in Burma or the Himalayas are the Chinese *R. sinensis* and *R. vestitus*, which Anderson regards as identical. The remaining species of the genus inhabit Abyssinia.

Family HYSTRICIDÆ.

The porcupines and their near allies constitute this family and are easily recognized by their fur being more or less completely modified into spines. Spines, it is true, occur in some other rodents, but not to the same extent.

The form is robust (the largest Indian rodents belong to this family) and the limbs subequal. The clavicles are imperfect in all Indian forms; the fibula distinct. The zygomatic arch is stout, the malar bone not supported below by a continuation of the maxillary zygomatic process. Infraorbital opening large. The angular portion of the mandible arises from the outer side of the bony socket of the lower incisor. Facial part of the skull short and broad. Molars with external and internal enamel plaits, semirooted in all Indian genera.

Two genera occur within Indian limits.

- A. Tail short, spinose, with hollow quills at the end. **HYSTRIX**.
 B. Tail long, scaly, with a tuft of bristles at the end. **ATHERURA**.

Genus **HYSTRIX**, L. (1766).

Syn. *Acanthion*, Cuv.; *Acanthochærus*, Gray.

Body covered with rigid spines, some longer flexible spines being added on the back, the stoutest spines attached to the loins and rump. Tail short, spinose, and having at the end a bundle of slender-stalked open quills. Muzzle blunt. Mamme 6.

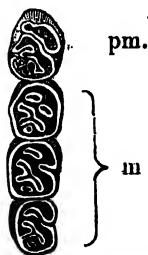


Fig. 144.—Crowns of right upper cheek-teeth of *H. leucura*, $\times 1$.

In the skull the nasal bones are well developed, much more so, however, in some species than in others. There are large air-sinuses in the frontals. Nasal cavity usually very large.

Dentition: i. $\frac{2}{2}$, pm. $\frac{1-1}{1-1}$, m. $\frac{3-3}{3-3}$. The upper grinding-teeth with one internal and three or four external folds; the folds become, with wear, loops of enamel inside the margin of the tooth. Lower teeth similar but with the folds reversed.

Vertebrae: C. 7, D. 15, L. 4, S. 4, C. 10-12: Toes 5-5, the pollex small.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. A crest of bristles 6 to 12 inches long or more on neck and shoulders *H. leucura*, p. 442.
 B. Crest present but less than 6 inches long *H. bengalensis*, p. 444.
 C. Crest wanting or quite rudimentary *H. hodgsoni*, p. 444.

One species of *Hystrix* is found fossil in the Pliocene Siwaliks and another in the Pleistocene cave-deposits of Kurnool.

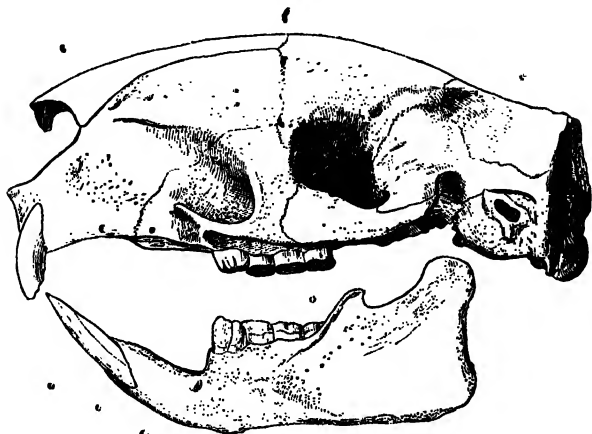


Fig. 145.—Skull of *Hystrix leucura*, $\times \frac{1}{2}$.

315. *Hystrix leucura*. *The Indian Porcupine*.

Hystrix cristata, var. *indica*, Gray and Hardwicke, *Ill. Ind. Zool.* ii, pl. 14 (1830).

Hystrix leucurus, Sykes, *P. Z. S.* 1831, p. 103; Elliot, *Mad. Jour. L. S.* x, p. 218; Kelaart, *Prod.* p. 70; Adams, *P. Z. S.* 1858, p. 520; Blyth, *Cat.* p. 128; Jerdon, *Mam.* p. 218.

Hystrix hirsutirostris, Brandt, *St. Petersb. Acad. Mem.* i, 1835, p. 375; Waterhouse, *Mammalia*, ii, p. 454; Blyth, *J. A. S. B.* xxi, p. 351.

Hystrix zeylonensis, Blyth, *J. A. S. B.* xx, p. 171 (1851).

Hystrix malabarica, Sclater, *P. Z. S.* 1865, p. 353, pl. xvi; 1871, pp. 233, 234.

Sáyi, Sáhi, Sáyal, Sarsel, H. &c.; Sájrú, B.; Dumsi, Chotia-dumsi, Nepal; Saori, Chaodi, Guzrati; Salendra, Mahr. of the Gháts; Sinkor, Sindhi; Sikhan, Baluch.; Shkunnr, Pushtu; Hoigu, Gond.; Jekra, Korku; Jiki, Ho-Kol; Yed, Mül-handi, Can.; Yeddu pandi, Tel.; Maldánpani, Tam. Mal.; Hítava, Cingalese.

A crest of very long coarse bristles, from 6 or 8 inches to occasionally over a foot in length, commencing on the forehead and extending along the spine to the middle of the back. Muzzle densely clad with hair; fore part of body, limbs, and abdomen covered with short spines mingled beneath with hair; the loins and base of tail with long spines, those situated anteriorly long and flexible, the others on the lower back and rump stout and rigid, so that the long flexible spines conceal the stouter quills except when all are erected. Skull moderately convex above, the nasals being nearly twice the length of the frontals, and having their lateral margins subparallel and their hinder border transverse; posterior

portion of premaxillary not differing greatly from a nasal in breadth. Mammæ 6, pectoral, laterally placed.

Colour blackish brown, with the exception of the tips of the quills on the cheeks and on a band across the throat (forming a collar), the terminal one fifth to one half, and one, two, or three narrow rings on the long dorsal quills, and all the spines and hollow quills of the tail, which are white. A few of the crest-bristles also are tipped with white or whitish in some individuals. The quills around the base of the tail are in great part white, and there is often a mesial line of white spines on the lower back. In some specimens the caudal spines and the tips and rings on the dorsal quills are partly orange-red instead of white.

Dimensions. Head and body 28 to 32 inches, tail 3 or 4, with spines 7 or 8, hind foot from heel 3.75; basal length of adult skull 5.5, zygomatic breadth 3.2. Weight 25 to 30 lbs.

Distribution. Throughout India and Ceylon, extending into the lower spurs of the Eastern Himalayas and to the westward far into the mountains, this species being found in Kashmir. A closely allied form, probably merely a variety *, extends throughout Western Asia to the Caspian and Black Sea. *H. leucura* has not been recorded east of the Bay of Bengal.

Habits. During the day the Indian porcupine remains in caves amongst rocks, or in burrows made by itself in hillsides, river-banks, bunds of tanks, &c. It has a predilection for rocky hills, and it is frequently gregarious. It rarely leaves its burrow till after sunset and generally returns thereto before sunrise. From being so thoroughly nocturnal, this, one of the commonest wild animals of India, is seldom seen. It feeds on vegetables, principally on roots, and is destructive to crops, especially to garden produce (peas, potatoes, onions, carrots, &c.), and to fruit, and is said to be very dainty and particular in its choice of food.

When irritated or alarmed porcupines utter a grunting sound and erect their spines with a peculiar rattling noise, produced, apparently, by the hollow tail-quills. When attacked by dogs or other animals, they charge backwards and inflict severe wounds with the rigid spines of their hind quarters. In confinement porcupines often gnaw, with their powerful teeth, through wooden cases or cages. They are fond of gnawing bones, and I have seen an elephant's tusk, found in the forest, deeply scored by their incisors. The flesh of the porcupine is well known to be excellent eating. From two to four young are produced at a birth, and are born with their eyes open and the body covered with short soft spines.

* This is often called *H. cristata*, L. (as it was by myself in 'Eastern Persia, ii, p. 80). Waterhouse, however, 'Mammalia,' ii, p. 148, showed that the Italian and North African species must retain the Linnaean title. In true *H. cristata* the skull is very tumid, the nasals being enormous, more than 3 times the length of the frontals, much wider than the premaxillaries, and having together an oval contour.

316. *Hystrix hodgsoni*. The crestless Himalayan Porcupine.

Acanthion hodgsonii, Gray, *P. Z. S.* 1847, p. 101.

Hystrix aloplus, Hodgson, *J. A. S. B.* xvi, p. 771, pl. xxxii (1847).

Hystrix hodgsoni, Waterhouse, *Mammalia*, ii, p. 461.

Hystrix longicauda, Blyth, *Cat.* p. 129, partim; Jerdon, *Mam.* p. 221, nec Marsden.

Anchotia dumsii, Nepalese; *Sathung*, Lepcha; *O-e*, Limbu; *Midi*, Cachari; *Subon-dem*, Manipuri; *Suku*, Kuki; *Sisi*, Daphla; *Tuigon*, Soke, Liso, *Vikhá*, *Sekru*, Naga.

No crests on head, neck, or shoulders as a rule, but occasionally a few bristles, slightly longer than the neighbouring spines, in a line on the back of the neck. Anterior portion of body, limbs, and abdomen covered with short flexible spines, flattened and deeply grooved, with hair-like terminations. Longer rigid spines and, scattered amongst them, still longer thin flexible spines, some of the latter often 10 inches in length, on the loins and rump. In the skull the nasals are about $2\frac{1}{2}$ times the length of the frontals and have a convex posterior termination.

Colour dark brown, blackish on the limbs. A narrow band of white-tipped spines forms a collar in front of the neck; longer quills of the back having sometimes the base, sometimes the tip, sometimes both white. Tail-quills of black and white mixed.

Dimensions. Head and body 23 inches, tail 4, or with the quills 8; basal length of skull 4.4, zygomatic breadth 2.5. Weight 16 to 20 lbs.

Distribution. The lower slopes of the Himalayas in Nepal and Sikkim up to about 5000 feet, and Assam. A crestless porcupine inhabits Burma and other countries east of the Bay of Bengal, but whether the present species or *H. longicauda* is uncertain.

Habits. According to Hodgson these porcupines are monogamous, living in burrows, and resembling *H. leucura* in habits and food. They breed in spring and produce usually two young. The flesh is excellent and is much esteemed.

"

317. *Hystrix bengalensis*. The Bengal Porcupine.

Hystrix bengalensis, Blyth, *J. A. S. B.* xx, p. 170 (1851); *id. Cat.* p. 128; *id. Mam. Birds Burma*, p. 42; Jerdon, *Mam.* p. 220.

Sajru, Bengali; *Phyu*, Burmese.

This resembles *H. hodgsoni* and *H. longicauda* in size and general character, having only a very few long and slender quills intermixed with the ordinary weapon-quills. The latter are much longer and thicker than in *H. hodgsoni*, and the body-spines are still flatter and more strongly grooved and terminate towards the neck in slight setæ, towards the quills in rigid points. There is a distinct but small thin crest, the longest bristles of which measure 5 or 6 inches and are tipped with white for the terminal third; and the white demi-collar is strongly marked. General colour as in

H. hodgsoni, the quills generally having the basal half white, the rest black, most of them with a white tip more or less developed, the few long and flexible quills white with a narrow black band about the middle. Tail as in *H. hodgsoni*.

The above is an abridged copy of Blyth's original description. Jerdon gives the length of the head and body as 28 inches, tail 4.

Distribution. Lower Bengal, Assam, Arrakau, and probably Burma generally. Specimens have also been brought from Sikhim.

I have not been able to examine a specimen of this species. Anderson (An. Zool. Res. p. 333) describes the skull as closely resembling that of *H. longicauda* (Marsden, History of Sumatra, p. 118, pl. xiii), with which *Acanthochoerus grotei* of Gray (P. Z. S. 1866, p. 310) is said to be identical (see Selater, P. Z. S. 1871, p. 234). Mr. Thomas has shown to me a skull with broad nasals collected by Mr. Fea in Karennee, and agreeing fairly with Anderson's description of that of *H. bengalensis*. The frontals are about half the length of the nasals, and the breadth of the nasals in front is nearly the length of the frontals. Basal length 4.75 inches, zygomatic breadth 2.7. As I find a rudimentary crest in some specimens of *H. hodgsoni*, the presence or absence of a small crest is not a specific character.

The skulls of *H. longicauda* (from Malacca, identified by Cantor) and *H. bengalensis* differ from that of *H. hodgsoni* in having the nasal bones not more than twice the length of the frontals. The crestless *H. javanica*, Cuv., from Java, and the small crested *H. yunnanensis* (Anderson, An. Zool. Res. p. 332), from Yunnan, have the frontals nearly as long as the nasals.

The remaining Asiatic forms of *Hystrix* besides *H. yunnanensis* and *H. javanica* are the Chinese *H. subcristata*, Swinhoe (P. Z. S. 1870, p. 638), and *H. crassispinis*, Günther (P. Z. S. 1876, p. 736, pl. lxx), from Borneo. *H. muelleri*, Jentink (Notes Leyd. Mus. 1879, p. 87), from Sumatra, is identical with *H. longicauda* of Cantor and others.

Genus **ATHERURA**, Cuv. (1829).

Tail elongate, about half the length of the head and body, scaly, with spiny bristles between the scales, and furnished with a tuft of long bristles partly flattened at the end. Spines of body flattened and grooved throughout, those of the lumbar region and rump not greatly exceeding those of the shoulders in length.

Skull much as in *Hystrix*, but the nasal cavity is smaller and the nasal bones shorter than the frontals. Dentition as in *Hystrix*.

But a single species is found within Indian limits and this is restricted to the countries east of the Bay of Bengal. Formerly, however, the genus must have existed in the Indian Peninsula, for its teeth have been found in the Pleistocene cave-deposits of Kurnool.

318. *Atherura macrura*. *The Asiatic brush-tailed Porcupine.*

Hystrix macroura, *L. Syst. Nat.* i, p. 77 (1766).

Hystrix fasciculata, *Shaw, Gen. Zool.* ii, p. 11; *Gray and Hærdw.*

Ill. Ind. Zool. ii, pl. 15.

Atherura fasciculata, *Cantor, J. A. S. B.* xv, p. 257; *Blyth, Cat.* p. 129; *id. Mam. Birds Burma*, p. 43; *Sclater, P. Z. S.* 1871, p. 236.

Atherura macrura, *Waterhouse, Mammalia*, ii, p. 472; *Blyth, J. A. S. B.* xx, p. 519; *Günther, P. Z. S.* 1876, p. 742; *Thomas, P. Z. S.* 1886, p. 71.

Lândak, Malay.

Body covered with rigid spines above, those of the lumbar region longer and mixed with a few still longer flexible bristle-like spines; head and lower parts covered with soft flattened spines. The tail is spiny near the base, then scaly, spiny bristles emerging between

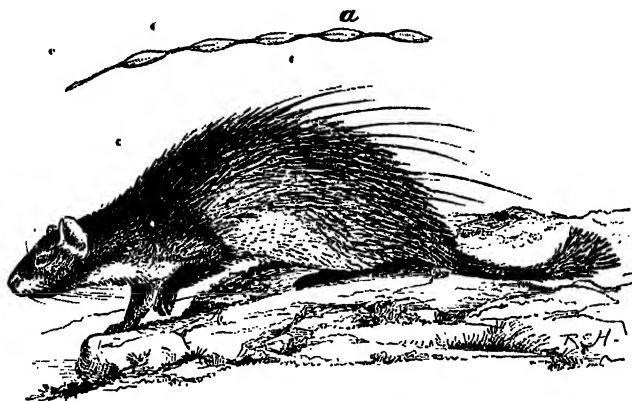


Fig. 146.—*Atherura macrura*; a, one of the bristles at the end of the tail.

the scales, at the tip is a tuft of longer bristles, partly simple, but chiefly each composed of three or four elongate elliptical flattened disks joined together end to end, and to the tail by short bristles.

Colour above dark brown, either uniform or with the tips of the spines paler; the long lumbar bristles mostly white, lower parts and bristles at the tip of the tail whitish.

Dimensions. Head and body of a male 22 inches, tail 10, of a smaller specimen 18.5 and 9; basal length of skull 3.4, zygomatic breadth 1.8.

Distribution. Burma and the Malay countries, extending northward to Chittagong, Tipperah, and the Khási hills, and southward to Java, Sumatra, and perhaps Borneo.

Habits. Similar to those of *Hystrix*.

The only remaining species of the genus, *A. africana*, occurs in Western and Central Africa. Another Oriental genus is *Trichys*, of which one species, *T. guentheri*, inhabits Borneo. The American porcupines belong to a distinct subfamily, *Synetherinae*.

Suborder *DUPLICIDENTATA*.

This suborder, distinguished by having two pairs of upper incisors in adults, the smaller additional pair being behind the usual rodent teeth, not at the side of them, comprises two families—the hares and the *Lagomyidæ*, sometimes known as Pikas, calling or piping hares, or mouse-hares. In all there are, at birth, three pairs of upper incisors, but the outer tooth on each side is soon lost. Enamel extends all round the incisors. The molars are rootless, with transverse enamel-folds. The anterior palatine or incisive foramina are very large, usually confluent, and extending back to the premolars; the bony palate is very short; and the opening of the posterior nares is between the true molars. There is no true alisphenoid canal. The fibula is ankylosed to the tibia and articulates with the os calcis. The testes are permanently external to the abdominal cavity. All the species are exclusively vegetable feeders and have very long intestines and a large cæcua. All are terrestrial, none arboreal or aquatic.

Both families occur in India and are thus distinguished:—

| | |
|------------------------------------|-------------------|
| Ears long; a tail present | Leporidæ. |
| Ears short, rounded; no tail | Lagomyidæ. |

Family LEPORIDÆ.

Hares and rabbits compose this family. The ears are long, usually about the same length as the skull or longer, and there is a short tail. The limbs are long, the hind limbs in general conspicuously longer than the fore. The eyes are large and there are no eyelids. The skull is compressed; the frontals are broad between the orbits and furnished with peculiarly shaped post-orbital processes, narrow where joined, to the frontals, then expanded and forming the upper rim of the orbit. The clavicles are imperfect.

Dentition: i. $\frac{4}{2}$, pm. $\frac{3-3}{2-2}$, m. $\frac{3-3}{3-3}$. Toes 5-4. Vertebrae: C. 7, D. 12, L. 7, S. 4, C. 13-15.

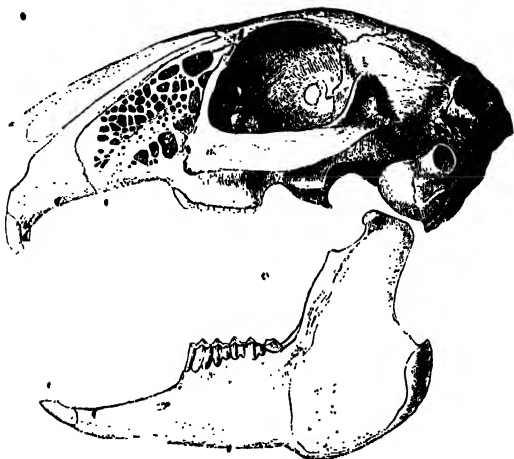


Fig. 147.—Skull of *Lepus nigricollis*, $\times \frac{1}{2}$.

But a single genus is usually recognized in this family. Hares are found in all geographical regions except the Australian.

Genus **LEPUS**, L. (1766).

Syn. *Caprolagus*, Blyth (1845).

Characters of the family. Hares are well known and scarcely require description. There are several Indian species, some found in tropical parts of the country, others confined to the Himalayas. As a rule two different species do not inhabit the same area, but *L. ruficaudatus* and *L. hispidus* may form an exception, as both apparently occur in Eastern Bengal and Assam.

Hares have much resemblance to each other in habits; as a rule they dwell in grass, or amongst bushes or rocks, each living solitarily in a particular spot, known as its *form*; usually a mere seat in the grass, or beside a bush or stone. To this form the animal returns, sometimes daily, for a considerable period, changing, however, with the season of year. Hares move about and feed in the morning and evening and at night, living entirely on grass and other plants. They are swift of foot, and owing to the length of their hind legs can ascend a slope at great speed. True hares do not burrow. They breed several times in the year; the period of gestation is about a month, and the young are born with their

eyes open and are able to reproduce at the age of about 6 months. In the European hare the young of the same litter are said to be sometimes dropped at considerable intervals. Rabbits differ from hares considerably; they dwell in burrows, and the young are born naked and with the eyes closed. The curious hispid hare also burrows.

Synopsis of Indian, Ceylonese, and Burmese species.

- A. Ears as long as the head or longer, tail white beneath.
 - a. A black patch on the back of the neck *L. nigricollis*, p. 449.
 - b. No black patch.
 - a'. Upper surface of tail rufous-brown; fur harsh *L. ruficaudatus*, p. 450.
 - or surface of tail blackish brown; fur soft *L. dayanus*, p. 451.
 - c'. Upper surface of tail black.
 - a''. General colour distinctly rufous .. *L. peguensis*, p. 451.
 - b''. General colour not rufous *L. tibetanus*, p. 452.
 - d'. Tail wholly or almost wholly white.
 - a''. Ear longer than hind foot with tarsus *L. oiostolus*, p. 452.
 - b''. Ear not longer than hind foot with tarsus *L. hypsilinus*, p. 453.
- B. Ears shorter than head, tail brown throughout; fur bristly *L. hispidus*, p. 454.

319. *Lepus nigricollis*. *The black-naped Hare.*

Lepus nigricollis, *F. Cuv. Dict. Sc. Nat.* xxvi, p. 307 (1823); *Elliot, Mad. Jour. L. S.* x, p. 218; *Kelaart, Prod. F. Z.* p. 72; *Blyth, Cat.* p. 132; *Jerdon, Mam.* p. 225.

Khargosh, H.; *Sassa*, Mahr.; *Malla*, Can.; *Musal*, Tam.; *Kundeli*, *Chourapilli*, Tel.; *Moilu*, Mal.; *Hava*, Cing.

Ears thinly clad. Fur somewhat harsh and coarse.

Colour above rufescent brown and black mixed, except a large black or brownish-black patch on the back of the neck, extending from the ears to the shoulders. Tail rufous-brown above, blackish towards the end. Fore neck, breast, and limbs rufous; chin, throat, and lower parts from fore limbs white, the dorsal and ventral tints passing gradually into each other on the flanks. Ears outside brown anteriorly, grey posteriorly, dusky towards the tip, narrowly margined with whitish inside. Dorsal fur ash-grey or creamy white at the base, then black, then rufous or rufescent white, the extreme tips black. Animals from the Nilgiri hills and Ceylon are more richly coloured than those from the plains, but one Nilgiri skin, sent to me by Mr. Hampson, is blackish brown above and not rufous.

Dimensions. Head and body 19 inches, ears 4·75, tail (without hair?) 2·5; a skull measures 2·9 in basal length and 1·65 in breadth across the zygomatic arches. Nilgiri hares weigh 5 to 8 lbs., but

in the plains the weight is less, Col. Hamilton (Hawkeye) says 5 to 7.

Distribution. The Indian Peninsula, south of the Godáviri, and Ceylon. This hare ascends hills and is found commonly on the Nilgiris and at Newera Ellia.

Habits. Nothing particular appears to have been recorded. Like *L. ruficaudatus*, this hare takes refuge in holes (on the Nilgiris, in hollow trees) when pursued, and like that species appears to have fewer young at a birth than the European hare. Mr. Davison tells me he has generally found one but not unfrequently two. On the Nilgiris this hare breeds chiefly from October to February.

320. *Lepus ruficaudatus*. The common Indian Hare.

Lepus ruficaudatus, Geoff. Dict. class. d'hist. nat. ix, p. 381 (1826);

Blyth, J. A. S. B. xi, p. 100; Cat. p. 131; Jerdon, Mam. p. 224.

Lepus timidus, McClelland, P. Z. S. 1839, p. 152, nec Linn.

Lepus macrotus, Hodgson, J. A. S. B. ix, p. 1183 (1840); Adams, P. Z. S. 1858, p. 520; Wagner, Hügel's Kaschmir, iv, p. 574, pl.

Lepus aryabertensis, Hodgson, Calc. Jour. N. H. iv, p. 293.

Lepus tytleri, Tytler, A. M. N. H. (2) xiv. p. 176 (1854); Blyth, J. A. S. B. xxii, p. 415, xxiv, p. 471.

Khargosh, P. & Hindustani; Khará, Suera or Sassa, H. & B.; Lambha or Lambhántu, II.; Malol, Gond.; Kulhai, Kol, Santál; Koarti, Korku; Manye, Paharia of Rajmehál.

Ears very thinly clad. Fur somewhat harsh and coarse; three pairs of mammae, 1 pectoral, 2 inguinal.

Colour above light rufous-brown mixed with black on the back and face; breast and limbs rufous; chin, upper throat, and lower parts from between the fore legs white. Fur of back creamy white (sometimes very pale ashy grey) at the base, then for a short distance dark brown to ashy brown, then pale rufous, and the extreme tips black. Tail above rufous-brown. Anterior outer and posterior inner surface of ears more thickly clad than the remainder of the ear-conch, dark brown mixed with rufescent. Near their tips the ears are narrowly bordered with black outside and with rufous inside.

Dimensions. Head and body 18 to 20 inches, tail with hair 4, ear from crown 5, breadth laid flat 2·75, hind foot and tarsus from heel to end of claws 4; basal length of skull 2·9, zygomatic breadth 1·55; weight 4 to 5 lbs. Males are smaller than females.

Distribution. Northern India generally, except in Western Rajputana, Sind, and the South-west Punjab. This species ranges from the foot of the Himalayas to the Godáviri or somewhat further south, being found, I believe, around Poona in the Deccan. To the eastward *L. ruficaudatus* occurs in Assam, to the north-west I have a specimen from Hazára.

Habits. This hare is chiefly found in waste ground or dry culti-

vation, amongst grass and bushes. It is common in many parts of Northern India, is often shot and occasionally coursed with greyhounds. When pursued it not unfrequently takes refuge in a fox's hole or some other burrow. In more than one instance, I have found a single foetus in the female; Hodgson, however, found two and states that this is the number of young generally produced at a birth.

The flesh is not so good as that of the European hare, though much of the usual inferiority is probably due to cookery. When jugged this hare is by no means unpalatable.

321. *Lepus dayanus*. *The Sind Hare*.

Lepus dayanus, *Blanford*, *P. Z. S.* 1874, p. 663.

Lepus joongshaiensis, *Murray*, *Vertebrate Zoology of Sind*, p. 51.

Sassa, Saho, Seher, Sindhi.

Ears thinly clad. Fur very soft. In the skull the nasals are shorter and much less bent over anteriorly at the sides than in *L. ruficaudatus*.

Colour above light greyish brown mixed with black; breast and limbs pale rufescent, lower parts except the breast white. Dorsal fur at base light grey to creamy white, paler posteriorly, beyond the middle of each hair is a black ring, then a whitish space, the tip being black. Tail blackish brown above. Face-stripes whitish; around eyes white. Margin of ear near the tip blackish brown outside, buff inside.

Dimensions. Head and body 17 inches, tail with hair 4, without hair 2·75, ear from crown 4·5, hind foot and tarsus 4; basal length of skull 2·75, zygomatic breadth 1·6.

Distribution. Sind and Cutch, with the greater part of the Indian desert east of the Indus, probably also the Derajat in the Punjab.

Habits. Similar to those of *L. ruficaudatus*. This is, however, more of a desert form. It is much greyer than *L. ruficaudatus* and at once distinguished by its soft fur, and by the upper surface of the tail being blackish brown instead of rufous.

322. *Lepus peguensis*. *The Burmese Hare*.

Lepus sinensis, *Blyth*, *J. A. S. B.* xxi, p. 359, nec *Gray*.

Lepus peguensis, *Blyth*, *J. A. S. B.* xxiv, p. 471 (1855); *id. Cat.* p. 132; *id. Mam. Birds Burma*, p. 43.

Fun, Phu-goung, Burmese.

Colour above rufous mixed with black, below white, the two colours well defined, not passing into each other. Dorsal fur pale grey or white at the base, then black, terminal portion fulvous brown with black tips. Tail black above. Towards the rump there is sometimes a strong ashy tinge on the back. A large blackish terminal patch on the posterior outer surface of each ear.

Dimensions. Head and body 21 inches, tail with hair 4, ear 4·25,

hind foot 4·5 (Tickell). A female skin in spirit is smaller, hind foot 4·1; the skull measures—basal length 2·7, extreme length 3·4, zygomatic breadth 1·6.

Distribution. Burma; in the Irrawaddy valley as far down as Henzada, wanting near the coast and in dense forest. Not recorded from Arrakan, but found to the southwest as far as the Thongyin valley west of Moulmein (Stray Feathers, ix, p. 141) and perhaps farther south. I am indebted to Major Bingham for a good skin of this species, of which there was until recently no specimen in Europe.

323. *Lepus tibetanus.* *The Afghan Hare.*

Lepus tibetanus, Waterhouse, *P. Z. S.* 1841, p. 7, *id. Mammalia*, ii, p. 58; Günther, *A. M. N. H.* (4) xvi, p. 228 (1875); Blanford, *Yark. Miss., Mam.* p. 63; Scully, *P. Z. S.* 1881, p. 207.

Lepus craspedotis, Blanford, *Eastern Persia*, ii, p. 80, pl. viii.

Lepus biddulphi, Blanford, *J. A. S. B.* xli, pt. 2, p. 324.

Ears broad. Fur soft.

Colour above varying from light greyish to light rufescent brown mixed with black, the rump sometimes with an ashy tinge; lower parts white, except the breast which is light brown. Tail with a broad black band above. Dorsal fur ashy at the base, varying in depth of tint, passing into whitish, then black or dark brown followed by a very pale brown ring and the extreme tip black. Often, in winter fur, longer fine black-tipped hairs are intermixed on the back. Outside of the ears brown in front, behind buff, passing into black at the tip. In most specimens the ear-conch is margined with buff.

Dimensions. Head and body 19 inches, tail 3·5 (with hair 5), ear 5, breadth of do. 3, hind foot and tarsus 4·8. Weight 3½ lbs. The skull is 2·75 inches in basal length and 1·7 in zygomatic breadth.

Distribution. The upper Indus valley (Little Tibet), the greater part of Afghanistan, and Baluchistan. This hare is found as low as 500 feet above the sea in the latter (*L. craspedotis*). I have shot it on the Khirihar range west of Sind and near Quetta.

324. *Lepus oiostolus.* *The woolly Hare.*

Lepus oiostolus, Hodgson, *J. A. S. B.* ix, p. 1186 (1840), xi, p. 288.

Lepus pallipes, Hodgson, *J. A. S. B.* xi, p. 288, pl. (1842), Blanford, *Yark. Miss., Mam.* p. 62.

? *Lepus tibetanus*, Blanford, *J. A. S. B.* xli, pt. 2, p. 34, *nec Waterhouse*.

Rigong, Tibetan.

Ears densely clad outside and exceeding the head in length. Fur soft, thick, woolly, slightly curled in adults, more so in the young. Postorbital processes in the skull large, broad, and bent upwards, so that the frontal area between the orbits is broad and concave.

Colour above light yellowish brown mixed with dark brown, rump

ashy grey. Tail almost entirely white, a few ashy hairs above near the base. Some of the fur on the back of the neck is tipped with ashy. Fore neck and breast pale rufescent, chin and abdomen white. Dorsal fur ashy at the base on the shoulders, white in the middle of the back, then dark brown or black followed by light brown, the tips of the longer hairs black. Ears externally dark brown in front, white behind, passing into ashy towards the base and black close to the tip, the border of the ear buffy white almost throughout; inside of ear-conch with short brown hair near posterior margin, except near the tip, where the hair is white. Eye-stripe whitish, whiskers mixed black and white. The young is pale brownish or slaty grey above.

Dimensions. Head and body 22 inches, ear 4·75, hind foot and tarsus 4·5, tail without terminal hair 4, with it 6; zygomatic breadth of skull 1·5.

Distribution. Tibet north of Nepal and Sikkim and probably farther east at high elevations. *L. oiostolus* occurs also in some of the high valleys south of the main range; I have seen it in Sikkim near the Kongra Lama pass.

This species is closely allied to *L. variabilis*, of which it and *L. hypsibius* may perhaps ultimately both prove to be varieties.

325. *Lepus hypsibius*. *The upland Hare*.

? *Lepus oiostolus*, Adams, *P. Z. S.* 1858, p. 520, nec Hodgson.

Lepus pallipes, Blyth, *Cat.* p. 131, nec Hodgson.

Lepus hypsibius, Blanford, *J. A. S. B.* xlv, pt. 2, p. 214 (1875); *id.* *Yark. Miss., Mam.*, p. 60, pl. iii, fig. 1, pl. iv a, fig. 1.

Fur long, woolly, curly, and very thick, the hairs of the rump nearly 2 inches long in winter. Ears scarcely exceeding the head in length. Postorbital processes of skull large and bent upwards.

Colour above rufous-brown, mixed with black on the back, rump dark ashy. Tail entirely white. Lower parts white, except the breast which is rufescent. Fur ashy at the base on the shoulders, creamy white in the middle of the back, then there is a blackish ring followed by a longer pale brown one, the extreme tip black. Hair of rump ashy grey throughout, some piles black-tipped. Outer surface of ears brown in front, whitish behind, with the extreme tip black.

Dimensions from dried skins. Head and body 24 inches, ear 4·5, hind foot and tarsus 5; basal length of skull 2·8, zygomatic breadth 1·73.

Distribution. The higher plains of Ladak such as Changchemnó, and also of Rukshu. Not known to occur below 14,000 or 15,000 feet elevation.

This may be a variety of the last, but appears to be considerably larger with shorter ears.

326. *Lepus hispidus*. *The hispid Hare*.

Lepus hispidus, Pearson, *McClelland, P. Z. S.* 1839, p. 152; *Hodgson, J. A. & B.* xvi, p. 572, pl. xiv; *Blyth, Cat.* p. 133; *id. J. A. S. B.* xxii, p. 415; *Jerdon, Mam.* p. 226.

Caprolagus hispidus, *Blyth, J. A. S. B.* xiv. p. 249, plates.

Ears very short, shorter than the skull. Eyes small. Fur coarse, bristly; underfur fine with the coarse longer hairs intermixed. Hind legs short, but little exceeding the fore legs in length. Claws strong. Mammaræ 6. Skull very thick, flat above; frontals longer and nasals shorter than in other hares. Postorbital processes small, united to the frontals anteriorly; incisive foramina small; bony palate as long as broad. Teeth large.

Colour above black mixed with brownish white, producing a general dark brown aspect, and passing on the sides gradually into the sullied brownish white of the lower parts. The rump is more rufescent in some skins. Tail brown throughout, darker above. Basal half of dorsal fur greyish brown; terminal portion at first dark brown or black, then yellowish white followed by a long black tip sometimes interrupted by a second pale ring. Ears brown outside throughout. Breast a little darker brown than the abdomen.

Dimensions. Head and body 19 inches, tail 1·1, with hair 2·1, ear 2·75, hind foot and tarsus 3·9; basal length of skull 3, zygomatic breadth 1·75. Weight 5½ lbs.

Distribution. The tract along the foot of the Himalayas from Gorakhpur to Upper Assam. The hispid hare does not range into the mountains, but is said to be found as far south as the Rajmehal hills, Dacca, and, according to Hodgson, Tipperah.

Habits very imperfectly ascertained. According to Hodgson the hispid hare inhabits the *Sal* forest, whilst Jerdon states with more probability that it is found in the Terai (that is, of course, the marshy tract usually thus called), frequenting long grass, bamboos, &c. It is said to burrow like a rabbit, but not to be gregarious. Its food, as Hodgson was informed by the Mechis, consists chiefly of roots and the bark of trees. The flesh is said to be white.

This hare should perhaps be placed in a distinct genus *Caprolagus* as proposed by Blyth. An allied form, with black markings, *L. nitscheri*, has recently been described from Sumatra.

Family LAGOMYIDÆ.

The animals comprised in this family are of small size, all being considerably smaller than a rabbit. • The ears are short and rounded,

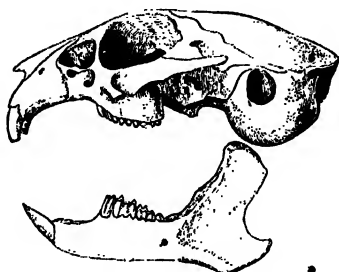


Fig. 148.—Skull of *Lagomys rufescens*, $\times 1$.

and there is no external tail. The skull is depressed, orbits elliptical and separated by a narrow frontal area. There are no postorbital processes. A narrow pointed bony lamina extends backwards from the zygomatic arch nearly to the meatus. The clavicles are perfect, the fore and hind limbs short and subequal.

Only a single genus is known.

Genus LAGOMYS, Cuvier (1798).

Characters of the family. The species are like a guinea-pig in form and inhabit burrows amongst rocks. Some have a peculiar call, on account of which they have been designated piping hares, but this peculiarity does not appear to have been observed in Himalayan species. In many of the forms, perhaps in all, individuals have rufous patches at the side of the neck corresponding apparently to glandular areas. All have the soles of all the feet hairy; the fur is generally thick and soft. The intestines are excessively long in all the species; I found them in *L. rufescens* to be 12 times the length of the head and body.

Dentition: i. $\frac{4}{2}$, pm. $\frac{2-2}{2-2}$, m. $\frac{3-3}{3-3}$. Vertebrae: C. 7, D. 18, L. 5, S. 2, C. about 10 (in *L. rufescens*).

The genus is chiefly confined to Central and Northern Asia, one species extending into Eastern Europe and one being found in North America. Several kinds inhabit the Himalayas, Tibet, and Afghanistan.

Synopsis of Indian Species.

- A. Ears moderate, less than an inch broad.
- a. Toe-pads exposed.
 - a'. Colour dark brown or bay, a narrow pale collar or none *L. roylei*, p. 456.
 - b'. Colour pale brown, a broad pale collar .. *L. rufescens*, p. 458.
 - b. Toe-pads concealed by hair, colour lightsandy brown *L. curzonæ*, p. 457.
- B. Ears more than an inch broad.
- a. Incisive foramen subtrigonal, with sides straight *L. macrotis*, p. 457.
 - b. Incisive foramen constricted in middle and with curved sides. Colour brownish yellow *L. ladacensis*, p. 458.

327. *Lagomys roylei*. *The Himalayan Mouse-Hare.*

Lagomys roylei, *Ogilby, Royle's Ill. Botany &c. Himalaya*, p. lxix, pl. 4 (1839); *Adams, P. Z. S.* 1858, p. 520; *Jerdon, Mam.* p. 226; *Blanford, J. A. S. B.* xli, pt. 2, p. 35; *Büchner, Przewalski, Reis. Mam.* p. 159, pl. xxiii, figs. 1, 2.

Lagomys nipalensis, *Hodgson, J. A. S. B.* x, p. 354, plate at p. 816 (1841).

Lagomys hodgsoni, *Blyth, J. A. S. B.* x, p. 817, plate at p. 844.

Lagomys tibetanus, *A. Milne-Edwards, Rech. Mam.* i, p. 314, pls. xlviii, xlix.

Rang-runt, rang-duni, in Kunawar; *Günchen*, Bhutia, Sikkim.

Ears moderate. Toe-pads naked. Incisive foramen subtriangular, with the sides nearly straight.

Colour above brown, varying from greyish brown to rufous brown, sometimes blackish brown, and in many cases bay or deep ferruginous on the neck only or on the head and neck, or throughout the upper surface. Lower parts paler, sometimes whitish. Basal three fourths of fur throughout the body leaden black, terminal fourth of the longer hairs light brown or rufous brown, with, on the upper parts, dark brown or black tips. Ears frequently with a narrow whitish border. Feet pale brown above, soles of hind feet darker brown. There is occasionally a narrow pale collar, but never a broad one as in *L. rufescens*.

Dimensions. Head and body 6·5 inches, tarsus and hind foot from heel to end of claws 1·1; length of ear 0·7, breadth 0·6. Some individuals are rather larger. Zygomatic breadth of skull 0·85.

Distribution. Found throughout the Himalayas from Kashmir to Moupin at elevations between 11,000 and 14,000 feet, or as high as 16,000 in Spiti, according to Stoliczka; also found by Przewalski in the mountains of N.E. Tibet, and of Kansu in China.

Habits. The Himalayan mouse-hare is chiefly found in rocky ground, burrowing and hiding amongst rocks and coarse stones. In the Eastern Himalayas it inhabits pine-forests on steep slopes. It is gregarious, several being found together; it feeds on vegetables

near its burrow, and darts into its hole when alarmed. Mr. A. Anderson found four young in a pregnant female; nothing more is known of its breeding-habits.

328. *Lagomys curzoniae*. *Hodgson's Mouse-Hare*.

Lagomys curzoniae, *Hodgson, J. A. S. B.* xxvi, p. 207 (1857); *Günther, A. M. N. H.* (4) xvi, p. 230.

Abra, Tibetan.

Ears moderate. Toe-pads hidden by long hair. Incisive foramen as in *L. roylei*, but orbits in the skull smaller and much closer together, nasals shorter and upper surface of skull more convex.

Colour light sandy brown above, nearly white below. Basal half or more of the fur leaden black, terminal portion whitish brown, longer dorsal hairs tipped black. Ears with a broad pale border, feet sullied white above and below. Chin dark brown.

Dimensions. Length (of a dried skin) about 8 inches, ear 0.75, tarsus and claws 1.25, zygomatic breadth of skull 0.83.

Distribution. The types were from the Tibetan (but Cis-Himalayan) Chumbi valley east of Sikkim; I have also two specimens procured by Mr. Mandelli's collectors, I believe from very high elevations in Sikkim.

This species is near *L. roylei*, but I think distinct, as the skull appears different.

329. *Lagomys macrotis*. *The large-eared Mouse-Hare*.

Lagomys macrotis, *Günther, A. M. N. H.* (4) xvi, p. 231 (1875); *Blanford, Yark. Miss., Mam.* p. 75; *Scully, P. Z. S.* 1881, p. 207; *id. A. M. N. H.* (5) viii, p. 100 (1881).

Lagomys auritus, *Blanford, J. A. S. B.* xlv, pt. ii, p. 111 (1875); *id. Yark. Miss., Mam.* p. 74, pl. vi, f. 2, pl. vii a, f. 2.

Ears large, rounded. Toe-pads exposed. Skull very similar to that of *L. roylei*.

Colour above from pale brownish yellow to smoky or wood-brown, below whitish. Fur leaden black for more than half the length, then sullied white, tips on the upper parts brown, a few with the extreme point black. Feet white. In some animals there is a rufous band across the throat, in others the head, rump, and shoulders are more or less rufous.

Dimensions. Head and body 7.2 inches, length of ear from orifice 1, hind foot from heel with claws 1.35; total length of skull 1.75, breadth across zygomatic arches 0.85.

Distribution. The type came from north of the Kuenlun range on the road from Yarkand to the Karakoram pass. Specimens have since been obtained by Scully and Biddulph in the Gilgit district at from 7500 to 13,000 feet.

The specimens described as *L. auritus* were procured by Dr. Stoliczka at Lukong on the Pangong Lake, Ladak.

Habits. According to Scully, this species frequents open stony ground near the snow-line. It is very locally distributed, but abundant where found.

An allied but distinct form *L. griseus* is found on the Kuenlun range, in the Sanju pass, south of Yarkand. It so closely resembles *L. rutilus* in winter fur, as figured by Büchner, that the two are probably identical. *L. rutilus* inhabits parts of Turkestan and Northern Tibet. Two other species from N. Tibet, *L. erythrotis* and *L. melanostoma*, have just been described by Büchner.

330. *Lagomys rufescens*. *The Afghan Mouse-Hare.*

Lagomys rufescens, Gray, *A. M. N. H.* x, p. 266 (1842); *Hutton*, *J. A. S. B.* xv, p. 140; *Blyth*, *Cat.* p. 133; *Blanf. Eastern Persia*, ii, p. 83, pl. vi, fig. 2; *Wood-Mason*, *P. A. S. B.* 1880, p. 173; *Scully*, *J. A. S. B.* lvi, pt. 2, p. 75.

Ears moderate. Toe-pads exposed. Fur short. Incisive foramen pyriform.

Colour above light rufescent brown to pale brownish rufescent, below sullied white. Fur leaden black for more than half the length, then brownish white, the points on the back black. A broad whitish collar round the back of the neck, succeeded behind by a dull rufous collar, sometimes sharply limited behind but generally passing gradually into the colour of the back. The rufous collar terminates on each side in a well-marked rufous patch in front of each shoulder. The pale colour is less distinct in the long winter fur and the rufous collar is not seen. Soles of feet whitish.

Dimensions. Head and body of a large male 7.5 inches, ear from meatus 0.8, hind foot from heel to end of claws 1.3; total length of skull 1.9, zygomatic breadth 0.9. Females are a little smaller.

Distribution. Found abundantly on the Bolán pass and the mountains around Quetta and thence northwards in many parts of Afghanistan. This *Lagomys* is also found in Afghan Turkestan, and near Isfahan in Persia. It appears not to occur at less than 5000 or 6000 feet above the sea.

Habits. Like most other species of the genus *L. rufescens* haunts rocky places in communities, dwelling in burrows and fissures and coming out to feed in the morning and evening. It is said to be easily tamed.

331. *Lagomys ladacensis*. *Stoliczka's Mouse-Hare.*

Lagomys curzoniæ, *Stoliczka*, *J. A. S. B.* xxxiv, pt. 2, p. 108; *Anderson*, *P. Z. S.* 1871, p. 562, nec *Hodgson*.

Lagomys ladacensis, *Günther*, *A. M. N. H.* (4) xvi, p. 231 (1875); *Blanford*, *J. A. S. B.* xlv, p. 110; *id.* *Yark. Miss.*, *Mam.* p. 71, pls. vi, vii, vii a.

Zabys, *Karin* or *Phise Karin*, Ladák.

Ears large, rounded. Toe-pads exposed in summer, but nearly concealed by long hairs in winter. Skull very different from those of other Himalayan species. The auditory bullæ are less tumid and differently shaped, and the cranium more convex above. The incisive



Fig. 149.—*Lagomys ladacensis*.

foramen is constricted about halfway between the incisors and premolars, and almost divided into a small anterior elongate elliptical orifice and a large posterior pyriform space between the premolars.

Colour above pale rufescent fawn with a greyish tinge varying to rufous, below pale buff or whitish. In worn summer fur, the face and back are distinctly rufous and the dark basal portion of the hair shows. Basal half of fur or more than half leaden black throughout the body, distal portion fulvous, tips on the back dark brown or black. Face and outside of ears generally more rufous than the back. Whiskers mixed black and white. Soles of feet pale-coloured. Young animals light-coloured.

Dimensions. Head and body 9 inches, ear from orifice 1.1, hind foot and nails 1.5; total length of skull 2.25, zygomatic breadth 1.25. These measurements are those of a large old individual.

Distribution. Eastern Ladak and Rukshu at great elevations between 14,500 and 19,000 feet.

Nothing particular has been recorded of the habits. The skull of this species differs from those of all other Himalayan and Afghan forms in the peculiarly shaped incisive foramen, which resembles those of *L. (Ogotona) dauricus* and *L. alpinus*. *L. rufescens*, however, is somewhat intermediate in this character between *L. ladacensis* and its allies on the one hand, and *L. roylei*, *L. curzonæ*, &c. on the other.

Many other species of *Lagomys* inhabit Central and Northern Asia.

Order UNGULATA.

The great order of hoofed quadrupeds, to which belong horses, rhinoceroses and tapirs, sheep, oxen, goats and antelopes, deer, pigs, hippopotami, and their allies, together with a vast number of extinct animals, is by most modern naturalists extended to include the elephants and hyraces, whilst by other systematists these animals are distinguished as separate orders called *Proboscidea* and *Hyracoides*. The first view is here accepted. The order Ungulata, thus defined, includes the Pachydermata and Ruminantia of Cuvier.

In general organization the Ungulates are much higher than Insectivores, Bats, and Rodents, and are but little inferior to Carnivores. All the living forms are terrestrial in their habits (except *Hippopotamus*), and all feed mainly or exclusively on vegetables.

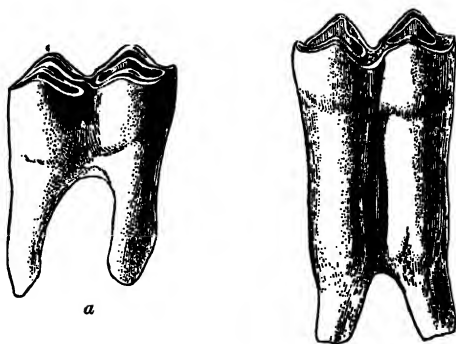


Fig. 150.—A. Brachydont lower molar of deer (*Cervus elaphus*), $\times 1$.
B. Hypsodont lower molar of ox (*Bos taurus*), $\times \frac{1}{2}$.

In all, the limbs are adapted for progression and not for prehension. All are heterodont and diphyodont, and their molars have broad crowns with tuberculated or ridged surfaces. The toes, except in *Hyrax* and the *Camelidae*, terminate in hoofs which enclose the ungual phalanges more or less completely; in a few forms the toes are connected together by the integuments, but as a rule they are free. The digits of each foot vary in number from five to one. Clavicles are wanting.

Ungulates are bunodont, when the crown of the unworn molars is tubercular, as in pigs; or selenodont, when it is composed of one

or more crescents, as in deer and oxen. They are termed hypsodont when the crown of each tooth is long and the root short, and brachyodont when the reverse is the case, as shown in the accompanying figure. The brachyodont is the normal or original form, and the great lengthening of the crown in horses, oxen, &c., appears to be the result of specialization. Rootless teeth with persistent pulps, like the incisors of rodents, elephants, and hippopotami, are a more advanced stage of the same specializing process. Hypsodont molars in a rodent have already been noticed in the case of *Eupetaurus* (p. 359).

The present order contains four existing suborders, of which three are Indian. They are thus distinguished:—

- | | |
|--|-----------------|
| A. <i>Os magnum</i> of carpus articulating with lunar or cuneiform, not with scaphoid. (<i>Subungulata</i> .) | |
| a. Size very large; a long flexible proboscis; toes 5—5 | PROBOSCIDEA. |
| b. Size small; no proboscis; toes 4 (5)—3. Resembling rodents | HYRACOIDEA. |
| B. <i>Os magnum</i> articulating with scaphoid (figs. 151, 157, pp. 468, 480); toes never exceeding 4 in number. (<i>Ungulata vera</i> .) | |
| a. Third or middle digit of all feet largest | PERISSODACTYLA. |
| b. The two median digits (3rd and 4th) equal | ARTIODACTYLA. |

The *Hyracoidea* (*Hyrax* or *Procavia*) are only found in Africa, Syria, and Arabia.

In preparing the following account of the Indian Ungulates, I have been able to make use of the important new work on "Mammals, living and extinct," by Flower and Lydekker, and of W. L. Sclater's new 'Catalogue of Mammalia in the Indian Museum'; whilst for details of habits and occasionally of coloration and measurement, especially those of Himalayan and Tibetan species, I have taken much from Kinloch's 'Large Game Shooting.' Sterndale's 'Mammalia of India and Ceylon' has also been of much service in the present as in other orders.

The Indian extinct Ungulata are so numerous that it is impossible to notice all in this work. Full details will be found in the 'Palæontologia Indica,' Series x. (Lydekker), and in Falconer's 'Fauna Antiqua Sivalensis' and 'Palæontological Memoirs.' A general list, with notes, by Lydekker has been printed in the Records of the Geological Survey of India for 1887, pp. 51–79. Earlier lists by the same writer appeared in 1880 (J. A. S. B. xlix, pt. 2, p. 8) and 1883 (Rec. G. S. I. xvi, p. 87).

SUBUNGULATA.

Suborder *PROBOSCIDEA*.

Nose produced into a long flexible proboscis, with the nostrils at the end, and serving as a prehensile organ. Incisors forming conical tusks, often of large size in male animals, never exceeding one pair in each jaw and confined to the upper jaw in living forms. No canines. Molars large, more or less elongate, with flat parallel sides and transversely ridged. Limbs stout; radius distinct from ulna and tibia from fibula. Feet massive, each with 5 toes, the outer more or less rudimentary. Stomach simple. A capacious cæcum. Testes permanently abdominal. Uterus bicornuate. Placenta non-deciduate, zonary. Mammaræ two, pectoral. Brain of low type, the cerebellum being entirely behind the cerebrum and uncovered by it.

The Proboscideans, although highly specialized, are of lower grade than other Ungulates. By many naturalists elephants and their allies are regarded as having affinities with Rodents.

A single family containing but one living genus. Of extinct forms a large number are found in later Tertiary beds, and from the Upper Miocene, Pliocene, and Pleistocene of India no fewer than 7 species of *Elephas* are known, besides 8 of the allied genus *Mastodon* and 2 of *Dinotherium*.

Family ELEPHANTIDÆ.

Genus *ELEPHAS*, Linn. (1766).

Dentition: i. $\frac{2}{0}$, c. $\frac{0}{0}$, m. $\frac{6-6}{6-6}$. The incisors (tusks) are preceded by milk-teeth, shed at an early age, and have enamel only on the tips before these are worn away, the remainder of each tusk consisting of solid dentine. The molars come into use successively from the back of the jaw, and are worn away and shed in front, not more than one, or portions of two, on each side of each jaw being in wear at once; the three anterior, which come first into use, being regarded as milk-molars not succeeded by premolars, whilst the last three are true molars. All are composed of enamel-covered plates or ridges of dentine with cement between. The number of transverse ridges increases from the first to the last molar.

Skull large, high, and globular, the greater portion consisting of cancellous tissue containing air-cells which communicate with the nasal passages. The brain is small, and lies far back between the

ear-orifices, or rather a little below them and in front of them. Nasal bones short and placed above the narial opening in the skull, which opening is high on the face. Malar small, forming only the middle part of the zygomatic arch, the anterior portion of which is a process of the maxillary, quite unlike the arrangement in true Ungulates. Vertebrae: C. 7, D. 19-21, L. 3-4, S. 4, O. 26-33.

In the limbs the upper or proximal segment (humerus or femur) greatly exceeds in length the distal segment (manus or pes). The ankle-joint or heel in the hind leg, corresponding to the hock of other Ungulates, is very little raised above the ground. Pelvis and scapula nearly vertical. Feet short and broad, the fore foot nearly circular, the hind foot smaller, longitudinally oval.

Elephants are purely herbivorous. There are two living species, one peculiar to Africa, and distinguished by a differently shaped head, larger ears, much fewer and differently shaped ridges on the molar teeth, and other characters, and one found in India.

332. *Elephas maximus*. *The Indian Elephant*.

Elephas maximus, L. *Syst. Nat.* i, p. 48 (1766), partim.

Elephas indicus, Cuv. *Règne An.* i, p. 231 (1817); Kelaart, *Prod.* p. 77; Blyth, *Cat.* p. 134; Falconer, *Nat. Hist. Review*, 1863, pp. 81, &c.; Jerdon, *Mam.* p. 229; W. Selater, *Cat.* p. 206.

Elephas sumatranus, Temm. *Coup d'œil Poss. Néer.* ii, p. 91 (1847); Schlegel, *Amsterdam, Verslag. Akad.* xii, p. 101 (1861); *id. Nat. Hist. Review*, 1862, p. 72.

Hathi (fem. *Hathni*), H.; *Hasti*, Gája, Sanso.; *Fil*, Pers.; *Haut*, Kashmiri; *Gáj*, Beng.; *Ane*, Tel., Tam., Can., Mal.; *Yáni*, Gond; *Hattanga*, *Khondha Eniga*, Tel.; *Yanei*, *Kunjaram*, *Veranum*, Mal.; *Ata*, *Alia*, Cing.; *Tengmú*, Lepcha; *Lámngchen*, *Lámboché*, Bhotia; *Mongma*, *Naplo*, Gáro; *Miyung*, Cachári; *Atche*, Aka; *Sotso*, *Supo*, *Chu*, *Tau*, Nága; *Sitte*, Abor; *Tsang*, Khámti; *Magui*, Singpho; *Saipi*, Kuki; *Amieng*, *Mányong*, Mishmi; *Sámú*, Manipuri; *Tsheng*, Burm.; *Tsing*, Talain; *Tsan*, Shan; *Káhsa*, Karen; *Gája*, Malay.

Skin nearly naked. Tail with a row of long coarse hairs for a few inches before and behind and round the end only. Five hoofs normally on each fore foot, four hoofs on each hind foot. The number of ridges in each molar from the first to the last is 4, 8, 12, 12, 16, and 24, with slight variation. Males as a rule have well developed tusks; some males, known in India as *mukna*, have merely short tusks like females.

Colour blackish grey throughout. The forehead, base of the trunk, and the ears often mottled with flesh-colour. White elephants are albinos.

Dimensions. The vertical height at the shoulder in adult elephants is almost exactly twice the circumference of the fore foot. Adult males do not as a rule exceed 9 feet, females 8 in height, but a male has been measured by Sanderson as much as 10 feet 7½ in.; Col. Hamilton says that Sir V. Brooke killed one of 11 feet; and a

skeleton *; now in the Indian Museum, Calcutta, measures 11 feet 3 in., so the animal when living, if the skeleton is correctly mounted, must have been nearly 12 feet high. Kelaart records having seen a Ceylon elephant of the same dimensions. A male 9 ft. 7 in. high measured 26 ft. 2½ in. from tip of trunk to end of tail. Weight of a male 8 feet high, 57 cwt.; of a female 7 ft. 6 in. high, 51 cwt. (P. Z. S. 1881, p. 450). The last two animals were not full-grown. Tusks vary greatly, the longest recorded I believe (Sir V. Brooke's, from Mysore) measured 8 ft. and weighed 90 lbs., but a shorter tusk from Gorakhpur is said to have weighed 100 lbs. Both were from elephants with but one tusk perfect. Two pairs from the Gáro hills are said to have weighed 157 and 155 lbs. respectively ('Asian,' October 16th, 1888, p. 35).

Distribution. The forest-clad portions of India, Ceylon, Assam, Burma, Siam, Cochin China, the Malay Peninsula, Sumatra, and Borneo, perhaps introduced in the last named. In India elephants are still found wild along the base of the Himalayas as far west as Dehra Dún; also in places in the great forest country between the Ganges and Kistna as far west as Biláspur and Mandla, in the Western Ghats as far north as 17° or 18°, and in some of the forest-clad ranges in Mysore and farther south. They do not appear to ascend the Himalayas to any elevation, but are sometimes found at considerable heights above the sea in Southern India, and in Ceylon they wander at times near Newera Ellia to over 7000 feet. Formerly the range of the elephant in India was greater; it was found wild about A.D. 1600 in Malwa and Nimar (Ain-i-Akbari, Gladwin's translation, ii, pp. 45 & 63), and at a much more recent date in Chánda, Central Provinces.

Habits. The following summary is chiefly taken from the admirable description by Sanderson in 'Thirteen years among the Wild Beasts of India,' chapters vi, viii, &c. Sir Emerson Tennent's account of the Ceylon elephants, though often quoted, is not, like Sanderson's, the result of personal observation, and is less accurate.

The country chiefly inhabited by elephants is tree-forest, undulating or hilly, generally containing bamboos in considerable quantities, but the animals often enter the high grass growing on alluvial flats. Individuals of various sizes and ages, and of both sexes, associate in herds, usually numbering 30 to 50, but not uncommonly more, sometimes 100. These herds often break up temporarily into smaller groups. The males are frequently found alone, but as a rule each belongs to a herd and joins it occasionally.

* The animal, I believe, when alive was the tusker of a small herd that for many years haunted the country north of the Rániganj coal-field, from Soory and the southern spurs of the Rájmehal hills to Jantára. Though I never came across them I often heard of them, and saw their old tracks between 1856 and 1860. Some fossil Indian elephants, for instance *E. ganesa* and *E. namadicus*, probably surpassed all living elephants in stature.

Since the above was written, I have been told by Mr. Sanderson that he compared the femur of the Calcutta skeleton with that of an elephant known to have been less than 10 feet high, and only found one-eighth inch difference in length.

All members of a herd generally belong to the same family, and are nearly related: different herds do not mix, but stray females or young males appear to obtain admission to a herd without difficulty. The leader of a herd is invariably a female. According to Sanderson a really solitary elephant is rare, many "rogue" elephants that have become notorious belonging to a herd.

The food of elephants consists principally of various kinds of grass, leaves and shoots of bamboos, wild plantains (*Musa*), of which both stems and leaves are eaten, and leaves, small branches, and bark of particular trees, especially of species of *Ficus*. Sanderson found by experiment that a full-grown elephant consumes between 600 and 700 lb. of green fodder per diem. Elephants drink twice a day in general, before sunset and after sunrise. Both food and drink are conveyed to the mouth by the trunk; tufts of grass or branches of trees are plucked by coiling the end of the trunk round them; leaves are stripped from boughs, and even bark from trees or branches, in a similar manner; only very small objects, such as small fruits, are picked up between the joints above and below the nostrils at the tip of the trunk. In drinking, the end of the trunk is immersed and the lower part (in Sanderson's opinion not more than 15 or 18 inches) filled by suction with water, which is then discharged into the mouth. Grain such as rice is eaten in a similar way, being drawn into the end of the trunk and then blown into the mouth.

In the wild state elephants roam about and feed for the greater part of the day and night, resting from about 9 or 10 A.M. till about 3 P.M. and again from about 11 P.M. to 3 A.M. They lie down to sleep like other mammals. Whilst feeding the herds scatter somewhat, but they quickly collect when alarmed. In many places elephants migrate considerable distances at particular seasons, chiefly in search of fodder, but partly it is believed to avoid insects, and generally from higher to lower ground or *vice versa*, or from one kind of forest to another. In marching, they keep in strict Indian file. They are fond of bathing and of rolling in mud in warm weather. They squirt water on their bodies with their trunks when heated, and when water is not at hand they draw some, by means not clearly understood, from the mouth or throat. The fluid thus obtained is probably a secretion, perhaps salivary. They sometimes, especially when exposed to the sun, throw dust or leaves over their backs.

The sense of smell is highly developed, but neither sight nor hearing is particularly acute.

The only pace of elephants is a walk, slow or quick, at times increased to a shuffling run. They are incapable of any motion resembling a gallop, or of the least jump, vertical or horizontal. A 7-foot trench is impassable by them, though a large elephant can clear $6\frac{1}{2}$ feet in its stride. They climb very steep places, bending the fore legs when ascending and the hind legs when descending, and kicking or pressing holes for the feet if necessary (J. A. S. B. xiii, p. 917, pl. ii). In kneeling down an elephant

first bends the hind legs one after the other, then the fore legs, which are stretched out in front; in rising the process is reversed.

Few animals not aquatic by nature swim as well as elephants. They have been known to swim for six hours or even more without resting. The pace is not rapid, probably about a mile an hour.

The principal sounds made by elephants are the following. First the shrill trumpet, varying in tone, and expressive, sometimes of fear, sometimes of anger. Secondly a roar from the throat, caused by fear or pain. A peculiar hoarse rumbling in the throat may express anger or want, as when a calf is calling for its mother. Pleasure is indicated by a continued low squeaking through the trunk. Lastly, there is a peculiar metallic sound made by rapping the end of the trunk on the ground and blowing through it at the same time. This indicates alarm or dislike, and is the well known indication of a tiger's presence. An elephant sometimes tries to frighten its enemies by blowing through its trunk.

Most elephants are timid inoffensive animals, though individuals are vicious; females with young offspring and solitary males or "rogues" being most disposed to attack. The attack is made with the trunk tightly coiled, the feet, and in males the tusks, being used for purposes of offence, and the adversary, if caught, is generally trampled upon.

I quite agree with Sanderson in believing that the intelligence of elephants has been greatly overrated. They are singularly docile and obedient—no other mammal is known to be capable of domestication when adult to nearly the same extent—and docility in animals is generally I think confounded with intelligence*. Judging by the development of its brain, an elephant is probably of lower intellectual capacity than other Ungulates.

Tame elephants very rarely breed in India. In parts of Burma and Siam breeding from tame females is said to be common. The period of gestation has been ascertained to be about 19 months (Heysham, P. Z. S. 1865, p. 731, and 1880, p. 23), though it is said to vary from 18 to 22; and according to some writers (*e. g.* Campbell, P. Z. S. 1869, p. 139) the latter period has been recorded (see also P. Z. S. 1880, p. 222, and J. Ac. Sc. Philad. (2) viii, p. 413). The young are generally born in September, October, and November, though a few are produced at other seasons. Twins are a rare exception, a single young one the rule. The young when born is about 3 feet high and weighs about 200 lb. It sucks with the mouth, not with the trunk, which is short and but little flexible. An elephant is full grown, but not fully mature, at 25 years of age, and individuals have been known to live over 100 years in captivity; in a wild state their existence probably extends to 150 years.

Male elephants are liable to periodical attacks of excitement, supposed to be of a sexual nature, though this does not appear

* 'Geology and Zoology of Abyssinia,' p. 225, note.

clearly proved. During such attacks the animals are said to be "mast," and are often dangerous to men or to other elephants. The attack is preceded and accompanied by the flow of an oily secretion from a small orifice in each temple. Sanderson says he has seen the same secretion in newly caught female elephants. A somewhat similar phenomenon occurs amongst camels.

Much has been written on the capture and hunting of elephants. Wild herds are usually driven into stockades or *Kheddahs*, enclosures made of trunks of trees. The animals are then secured, and removed one by one by the aid of tame elephants. Another mode of capture, especially of large males, is to follow them on females and to tie their hind legs when they are asleep. Some wild individuals are run down by fast tame elephants, and the neck or legs noosed.

UNGULATA VERA.

The true Ungulates form a very well-marked group, and all living forms are higher in organization than the Subungulates. They agree in the following characters:—The toes never exceed four in any foot; the first digit is always wanting. The malar or jugal bone in all living forms is in contact with the lachrymal, and is not confined to the zygomatic arch, but forms part of the wall of the skull. The *os magnum* of the carpus articulates with the scaphoid. The testes descend into a scrotum. The uterus is bicornuate, the placenta non-deciduate, and the chorionic villi either evenly diffused or collected in groups or cotyledons. The mammae are usually inguinal and never exclusively pectoral. Cerebral hemispheres well convoluted and covering part of the cerebellum.

Suborder *PERISSODACTYLA*.

This suborder is poorly represented at the present day—horses, rhinoceroses, and tapirs being the only surviving members of a group of animals that was extensively developed in the earlier Tertiary periods.

Perissodactyle Ungulates are characterized by the third or middle digit being much more developed than the others, and by its having the two sides similar. The number of digits in each foot is, as a rule, odd, and in living forms either one or three, except in tapirs, which have four toes on each fore foot. The femur bears a "third trochanter," a flattened and curved process from the outer side of the bone near the proximal end; the dorsal and lumbar vertebrae together are 22 to 24 in number; the nasal bones are expanded posteriorly, and there is an alisphenoid canal. The premolar and molar teeth in existing genera are similar and form a continuous series; the crown of the last lower molar is bilobed. The stomach is simple, the caecum large, the placenta diffused, and the mammae inguinal.

The three existing genera of this suborder constitute distinct subdivisions of considerably higher rank than ordinary families.

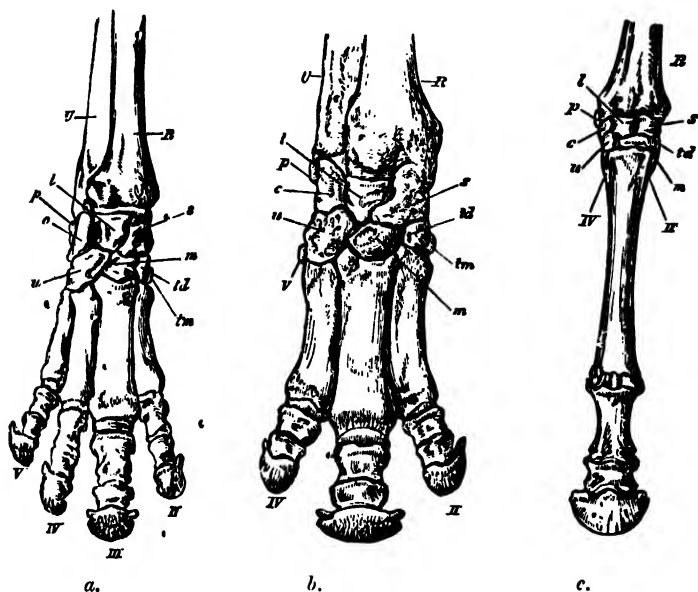


Fig. 151.—Bones of the manus of:—*a.* Horse (*Equus caballus*), *b.* Rhinoceros (*Rhinoceros sumatrensis*), *c.* Tapir (*Tapirus indicus*). II, III, IV, V, second, third, fourth, and fifth digits. *U*, ulna; *R*, radius; *c*, cuneiform; *l*, lunar; *s*, scaphoid; *u*, unciform; *m*, magnum; *td*, trapezoid; *tm*, trapezium. (From Flower's 'Osteology of Mammalia'.)

They may, however, for simplicity be classed as of family rank, and living forms may be distinguished thus:—

| | |
|---|-----------------------|
| Only one digit developed in each foot | Equidæ. |
| Three digits on each foot; one or two horns on the nose | Rhinocerotidæ. |
| Four digits on fore feet, three on hind; no horns | Tapiridæ. |

Family EQUIDÆ.

Genus **EQUUS**, Linn. (1766).

The characters of the family may, for convenience, be included in the description of the only living genus. In this each foot is formed of a single digit consisting of a metacarpal or metatarsal and three phalanges, the distal phalanx being surrounded by a

broad hoof. This single digit is the third (not, as was formerly thought by some naturalists, two toes united), the rudimentary metatarsals and metacarpals of the second and fourth digits forming the splint bones, one on each side*. The ulna and fibula are rudimentary and incomplete distally.

The general form is graceful, and the limbs are adapted for great speed. The head is elongate, there is a crest or mane of longer hairs along the back of the neck, and there are long hairs on the tail. Inside each forearm in all living species, and also inside each tarsus in the horse (*E. caballus*) only, is a peculiar callosity, the use of which is not known. There are two inguinal mammary.

Dentition : i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$. Canines generally wanting in females. There is sometimes an additional small anterior upper premolar. The incisors have a flat crown, with at first a deep hollow in the middle; this (the "mark" in horses) disappears with age. The premolars and molars have flat rectangular crowns with extremely complicated folds of enamel, and are of the hypsodont type, having elongate crowns and short roots. Vertebrae: C. 7, D. 18, L. 6, S. 5, C. 15-18.



Fig. 152.—Crowns of (a) upper and (b) lower second right true molars of *Equus hemionus*, the inner side uppermost.

This genus contains the horses, asses, and zebras, now restricted, in the originally wild state, to Asia and Africa, though wild horses, descended from tame animals, abound in parts of America. One species occurs on the north and west frontiers of India.

In late Tertiary times the genus had a far wider range, and remains of several species are found in Indian deposits. Two forms, one indistinguishable from *E. asinus*, the other closely resembling *E. hemionus*, are represented in the Karnul Caves (Pleistocene); a larger kind, *E. namadicus*, in the Pleistocene Nerbudda beds; and two species of *Equus*, besides four of the 3-toed *Hipparion*, in the Pliocene Siwaliks.

* In several extinct genera of *Equidae* other digits were developed, and a gradual passage from a four-toed form to the present greatly specialized single-toed type has been traced.

333. *Equus hemionus*. *The Asiatic Wild Ass.*

Equus hemionus, Pallas, *Nov. Com. Acad. Petrop.* xix, p. 394, pl. vii (1775); Sykes, *P. Z. S.* 1837, p. 91; Walker, *J. A. S. B.* xvii, pt. 2, p. 1, pl. i; Thomason, *P. Z. S.* 1848, p. 62; Blyth, *J. A. S. B.* xxvi, p. 239, note, xxviii, p. 229; Strachey, *J. A. S. B.* xxix, p. 136; Blyth, *Cat.* p. 136; George, *Ann. Sc. Nat.* xii, p. 23 (1860); W. Blanford, *Eastern Persia*, ii, p. 84; Aitchison, *Tr. L. S.* (2) v, p. 61; W. Sclater, *Cat.* p. 198.

Equus kiang, Moorcroft, *Travels*, i, p. 312 (1841); Hay, *P. Z. S.* 1859, p. 353, pl. lxxiii.

Asinus equigides, Hodgson, *J. A. S. B.* xi, p. 287 (1842).

Asinus polyodon, Hodgson, *Calc. Jour. N. H.* vii, p. 469, pl. vi (1847); viii, p. 98.

Asinus onager and *A. hemionus*, Gray, *Cat. Ung. Furb. B. M.* pp. 269, 272 (1852).

Equus onager, Blyth, *J. A. S. B.* xxviii, p. 229; *id.* *Cat.* p. 135; Jerdon, *Mam.* p. 230.

Equus hemippus, Is. Geoffr. *St. H. Compt. Rend.* xli, p. 1214 (1855).

Asinus indicus, Sclater, *P. Z. S.* 1862, p. 163.

Ghor-khar, P. & IL; *Ghur*, *Ghurán*, Baluch; *Kiang*, Tibetan.

Ears rather large. Tail covered with short hair near the base, growing gradually longer to the end. Mane erect. A naked callosity inside each forearm, none on the hind legs.

Colour. A dark brown stripe, sometimes with a whitish margin, along the back from nape to tail, and continued down part of the latter, the anterior part of the stripe formed by the mane; remainder of upper parts varying from rufescent grey (isabelline) to fawn colour or pale chestnut, lower parts white. Occasionally there is a dark cross stripe on the shoulder, and faint rufous bars are said to occur at times on the limbs. End of tail blackish. Tips of ears and hair close to hoof darker.

Dimensions. Height at shoulder 3 feet 8 inches to 4 feet. An adult female, that I shot on the Punjab and Sind frontier in 1882, measured: height 3 ft. 10 in., length from nose to rump over curves of back 6 ft. 11 in., length of tail (including hair) 2 ft. 2 in., ear from crown 9. A male skull from Tibet measures in basal length 17.5 inches, zygomatic breadth 7.8.

Distribution. Found throughout a large area in Central and Western Asia. Common in Ladak and throughout Tibet, north of the main Himalayan range. A few occur in Baluchistan, especially west of the Indus near Mithankot, on the Punjab frontier. Some are found east of the Indus, in Bickaneer, Jeysulmere, and on the Rann of Cutch.

Varieties. There are three forms of the Asiatic wild ass that have been classed as distinct species:—*E. hemionus* (the *Kiang*) of Tibet and Mongolia, *E. onager* v. *indicus* (the *Ghorkhar*) of Western India and Baluchistan, and *E. hemippus* of Persia and Syria. The last two by all accounts differ but little, but the *Kiang* is in general darker and redder than the *Ghorkhar* and has a narrower dorsal stripe. In the *Ghorkhar* this stripe is broader and narrowly

bordered with whitish or white. Other alleged differences, such as greater size in the *Kiang*, and the presence of a cross shoulder-stripe in the *Ghorkhar*, are not borne out by specimens I have examined. I agree with Sykes, Blyth, Strachey, George, and Flower in classing all these wild asses as one species.

Habits. The Asiatic wild ass inhabits desert or semi-desert plains, and is usually found in herds varying in number from 4 or 5 to 30 or 40 individuals; occasionally much larger numbers collect; Dr. Aitchison, in North-western Afghanistan, saw a herd that he estimated to contain 1000 animals. This was in April, and the large herds are said to consist of mares and foals.

The food consists of various grasses, green or dry, and of other plants. The voice of this animal has been described as a shrieking bray. Wild asses are renowned for speed, but in the Rann of Cutch adults have been run down by men on horseback and speared. I believe, however, the animals run down were mares in foal. The young are captured by using relays of horsemen to hunt them until tired out.

In the country west of the Indus the mares are said to drop their foals in June, July, or August. The period of gestation is probably the same as in the horse and ass, about 11 months.

Family RHINOCEROTIDÆ.

Genus **RHINOCEROS**, Linn. (1766).

In this family also all living species are by most naturalists referred to a single genus. There are three toes on each foot, each toe terminating in a small hoof-like nail. The size is large, the general form is heavy, and the legs are short and stout. The skin in all living forms is thinly clad with hair or is naked, and in all Indian species it is thick (so much so, that it was formerly supposed to be bullet-proof) and thrown into deep folds in places. One or two dermal horns are situated on the median line above the snout. These horns grow throughout the animal's life, and if lost are reproduced. The head is large, the eyes small, and the ears moderate. There are two inguinal mammæ.

The skull is elongate, with a high occipital crest. The nasal bones are large and united, broad behind, and in contact or nearly in contact with the large lacrymals; they are arched in front and project over a wide space that separates them from the premaxillaries. There are no postorbital processes, the orbits opening into the temporal fossæ. Tympanics small, not forming bullæ.

Dentition: i. $\frac{2(4)}{2(4)}$, c. $\frac{0}{0}$, pm. $\frac{4-4}{4-4}$, m. $\frac{3-3}{3-3}$. The incisors are somewhat variable: all are deciduous in African species; in adults of the Asiatic forms there are generally one pair, broad and blunt, in the upper jaw, and one or two pairs in the lower, the outer pointed

and formidable weapons; according to some these are lower canines. The anterior premolar in both jaws is very often wanting. The other upper premolars and molars are subquadrate with a longitudinal crest along the outer side and peculiarly incurved ridges on the inner; lower molars and premolars narrower, each formed of two crescentic ridges. The patterns on the teeth after wear are shown by the accompanying figure. Vertebrae: C. 7, D. 19-20, L. 3, S. 4, C. about 22. Ulna and fibula well developed and distinct.

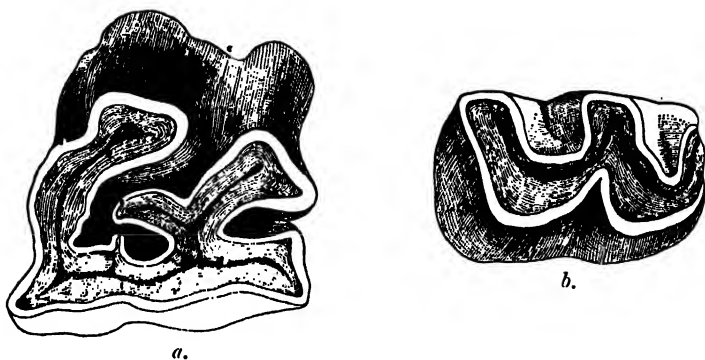


Fig. 153.—Crowns of (a) upper and (b) lower second right true molars of *Rhinoceros unicornis*, the inner side uppermost.

The genus is only found living in Africa and South-eastern Asia. Formerly it was widely distributed. Three extinct species, besides *R. unicornis*, have been recorded from the Pleistocene, and five from the Pliocene and Miocene beds of India.

Synopsis of Indian and Burmese Species.

A. A single horn on the nose.

a. Fold in front of shoulder not continued over back of neck; skin of sides bearing tubercles *R. unicornis*, p. 472.

b. Fold in front of shoulder continued over back of neck; skin of sides divided into small polygonal scales *R. sondaicus*, p. 474.

B. Two horns on nose *R. sumatrensis*, p. 476.

334. *Rhinoceros unicornis*. *The great one-horned Rhinoceros.*

Rhinoceros unicornis, *L. Syst. Nat.* i, p. 104 (1766); *Hodgson, P. Z. S.* 1834, p. 98; *Gray, P. Z. S.* 1867, p. 1010; *Sclater, P. Z. S.* 1871, p. 8; *id. Tr. Z. S.* ix, p. 645, pl. xcv; *Flower, P. Z. S.* 1876, p. 454; *W. Sclater, Cat.* p. 202.

Rhinoceros indicus, *Cuv. Règne An.* i, p. 239 (1817); *Blyth, J. A. S. B.* xxxi, pp. 151, 199; *id. Cat.* p. 136; *Jerdon, Mam.* p. 232; *Lydekker, J. A. S. B.* xlix, pt. 2, p. 135; *Cockburn, J. A. S. B.* lii, p. 56.

Rhinoceros stenoccephalus, *Gray, P. Z. S.* 1867, p. 1018.

Guinda, Gargadan, H.; Karkadan, P.; Gonda, Beng.

Skin naked except on the tail and ears, and on the sides studded with convex tubercles, half an inch to an inch or rather more in diameter, the largest on the buttocks and thighs and on the shoulders. Skin of body divided into great shields by folds before and behind each shoulder, and before each thigh; the folds behind the shoulders and before the thighs continuous across the back, those in front of the shoulders not joined across the back but turning backwards and lost above the shoulder. There are also great folds round the neck, others below the shoulders and thigh-shields and behind the buttocks, so that the tail lies in a groove. Epidermis on limbs forming small polygonal scales. The head is higher and altogether larger than in other Asiatic species. Incisors generally $\frac{2}{4}$; inner lower incisors small, outer large, pointed. Skull very high, mesopterygoid fossa narrow; hinder margin of bony palate simply concave. Horn well developed in both sexes.

Colour blackish grey throughout.

Dimensions. Height at shoulder 5 feet to 5 feet 9 inches. A large male measured: height 5 ft. 9 in., length from nose to root of tail 10 ft. 6 in., tail 2 ft. 5 in., girth 9 ft. 8 in. (*Kinlosk*). Length of horn rarely exceeding a foot. Basal length of a skull 23 inches, zygomatic breadth 15·3.

Distribution. At the present day the great Indian rhinoceros is almost restricted to the Assam plain, and it is very rare, if it exists, west of the Teesta river. Twenty to thirty years ago it was still common in the Sikhim Terai, and not many years previously it was found along the base of the Himalayas in Nepal and as far west as Rohilkund. Up to about 1850, or rather later, some rhinoceroses inhabited the grass-jungles on the Ganges at the north end of the Rájmehal hills, and were, I think, probably *R. unicornis*. Formerly this animal was extensively distributed in the Indian Peninsula. It was common in the Punjab as far west as Pesháwar in the time of the Emperor Baber (1505–1530). Semifossilized remains of it have been found in the Banda district, North-west Provinces, and near Madras; and its co-existence with several mammals now extinct, the Indian hippopotamus for one, is shown by its occurrence in the Pleistocene beds of the Nerbudda Valley.

Habits. The great Indian rhinoceros is a denizen of the grass-jungles, tracts of grass from 8 to 20 feet high, that cover so much of the uncultivated portions of the North-Indian alluvial plains. It appears never to ascend the hills; it has a distinct preference for swampy ground, and is fond of rolling in mud. Though each animal is solitary as a rule, several are often found in the same patch of jungle.

Despite its bulk and strength, this rhinoceros is as a rule a quiet inoffensive animal, the stories of its ferocity and of its deadly enmity to the elephant, that were copied from the not very veracious pages of Captain Williamson's 'Oriental Field Sports' into European works on natural history, being fables. A rhinoceros when wounded or driven about will, however, sometimes charge home, though this is an exception. When it does attack, this species

uses its sharp lower incisors (or, as some think, lower canines) much as a hog does. I was shown in Dooch Behar a straight horizontal scar on the leg of one of the Maharaja's elephants just above the foot. This I was assured on good authority was the mark of a

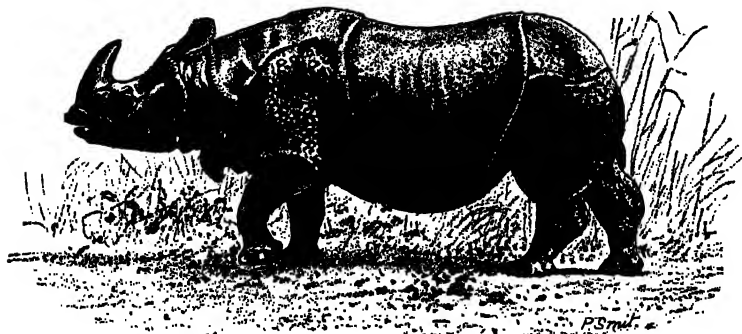


Fig. 154.—*Rhinoceros unicornis*.

wound inflicted by a rhinoceros, and it is manifest such a wound could not have been produced by the horn (see also Blyth, J. A. S. B. xi, p. 891).

The only sound known to be produced by the present animal is a peculiar grunt that it repeats frequently when excited. It is said by several writers to have a habit of depositing its dung in the same spot until a pile accumulates. The African *R. bicornis* has, I believe, no such habit.

Like other Ungulata, rhinoceroses can trot and gallop as well as walk. They as a rule sleep during the day and feed in the morning and evening. Their food consists, I believe, chiefly of grass. Their flesh is excellent, as I can testify. This rhinoceros is a long-lived animal and, according to Hodgson, is believed to live 100 years. I have heard of individuals that had existed 50 or 60 years in confinement. The period of gestation is said by Hodgson to be 17 or 18 months, by Desmarest under 9 months, a single young one being produced.

335. *Rhinoceros sondaicus*. The smaller one-horned Rhinoceros.

Rhinoceros sondaicus, Cuv., *Desm. Mam.* p. 399 (1822); *Blyth, J. A. S. B.* xxxi, p. 151; *id. Cat.* p. 137; *id. Mam. Birds Burma*, p. 50; *Jerdon, Mam.* p. 234; *Sclater, P. Z. S.* 1874, p. 182, pl. xxviii; *id. Tr. Z. S.* ix, p. 649, pl. xcvi; *Fraser, J. A. S. B.* xlv, pt. 2, p. 10, pl. v; *Flower, P. Z. S.* 1876, p. 454; *Ball, P. A. S. B.* 1877, p. 170; *Cockburn, P. A. S. B.* 1884, p. 140; *W. Sclater, Cat.* p. 202.

Rhinoceros javanicus, Cuv. *Hist. Nat. Mam.* livr. 45, pl. 309 (1824); *• Rainey, P. A. S. B.* 1878, p. 139.

Rhinoceros inermis, Lesson, *Compt. rendus du Buffon*, ed. 2; i. p. 514 (1848); Peters, *MB. Akad. Berl.* 1877, p. 68, pls. i-iii.

Rhinoceros nasalis and *R. floweri*, Gray, *P. Z. S.* 1867, pp. 1012, 1015.

Gainda, H.; Gondu, Beng.; Kunda, Kedi, Kweda, Naga; Kyeng, Kyan-tsheng, Burmese; Búddák, Malay.

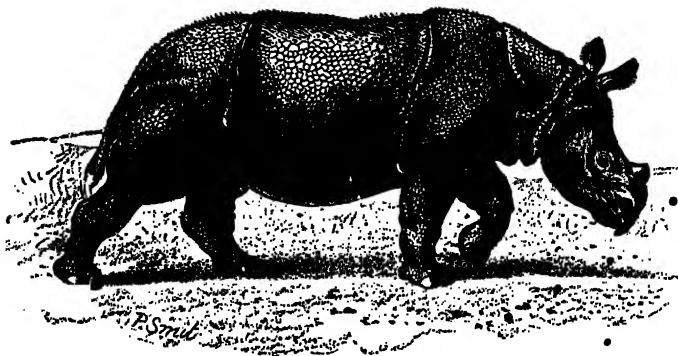


Fig. 155.—*Rhinoceros sondaicus*.

Animal altogether smaller, though scarcely, if at all, lower at the shoulder than *R. unicornis*; head much smaller. Skin naked or nearly so, not tubercular, the epidermis divided by cracks into small, polygonal, subequal scale-like disks throughout the body and limbs. Surface of body divided into shields by folds, as in *R. unicornis*, but the fold in front of the shoulders is continuous across the back like that behind the shoulders and that in front of the thighs. Neck-folds comparatively little developed. Incisors generally $\frac{3}{4}$; upper molars smaller and with a simpler pattern than those of *R. unicornis*; skull and mandible of less height, mesopterygoid fossa broad. Hinder margin of bony palate produced in the middle; a partially ossified septum narium. The horn is frequently, perhaps always, wanting in the female.

Colour dusky grey throughout.

Dimensions. Rather less than those of *R. unicornis*, but most of the measurements published appear to be those either of young animals or of individuals in confinement, which very often do not attain their full growth. A large female, according to Mr. Fraser and Mr. Cockburn, was 5 feet 6 inches high. A skull measures 23 inches in basal length, 13·8 in zygomatic breadth.

Distribution. The Sundarbans and parts of Eastern Bengal; Kinloch shot an undoubted specimen in the Sikhim Terai. From Assam this rhinoceros is found throughout Burma and the Malay Peninsula, and in Sumatra, Java, and Borneo. Blyth states that this species was formerly found near Rajnehal, but does not give any reason for the identification. The statement, mentioned by

Jerdon, that a few individuals existed in the forests of Orissa, has been ascertained by Mr. Ball and myself to be a mistake. So far as I am aware, there is no evidence at present that this rhinoceros ever inhabited the Peninsula of India. Its remains have, however, been found fossil in Borneo (P. Z. S. 1869, p. 409).

Habits. *R. sondaicus* is more an inhabitant of tree-forest than of grass, and although it is found in the alluvial swamps of the Sundarbans, its usual habitat appears to be in hilly countries. It has been observed at considerable elevations both in Burma and in Java; and the tracks seen by Major Macgregor south-east of Sadiya, at 7000 feet above the sea (Proc. R. Geog. Soc. 1887, p. 27), were probably made by this species. It is said to be more gentle and inoffensive than *R. unicornis*.

336. *Rhinoceros sumatrensis.* *The Asiatic two-horned Rhinoceros.*

Rhinoceros sumatrensis, Cuv. *Règne An.* i, p. 240 (1817); *Sclater*, P. Z. S. 1872, p. 790, pl. lxxvii; *id.* Tr. Z. S. ix, p. 650, pl. xcvi; *Anderson*, P. Z. S. 1872, p. 129; *Bartlett*, P. Z. S. 1873, p. 104, pl. xi; *Beddard & Treves*, P. Z. S. 1889, p. 7; *W. Sclater*, Cat. p. 204.

Rhinoceros sumatranus, *Raffles*, Tr. L. S. xiii, p. 268 (1820); *Blyth*, J. A. S. B. xxxi, p. 151; *id.* Cat. p. 137.

Rhinoceros crossei, *Gray*, P. Z. S. 1854, p. 251; *Blyth*, P. Z. S. 1861, p. 307; *id.* J. A. S. B. xxxi, p. 156.

Rhinoceros lasiotis, *Sclater*, P. Z. S. 1872, p. 493, pl. xxiii; *id.* Tr. Z. S. ix, p. 652, pl. xcvi; *Flower*, P. Z. S. 1878, p. 634; *W. Sclater*, Cat. p. 204.

Ceratohinus crossei and *C. sumatrensis*, *Blyth*, A. M. N. II. (4) x, p. 399 (1872); *id.* Mam. Birds Burma, pp. 51, 52.

Ceratohinus sumatranus, *C. niger*, *C. crossei*, and *C. blythii*, *Gray*, A. M. N. II. (4) xi, pp. 357-360, pl. xi (1873); *id.* Hand-list Edent. &c. Mam. B. M. pp. 47-50.

Ceratohinus sumatrensis and *C. lasiotis*, *Flower*, P. Z. S. 1876, p. 455.

Kyan, *Kyan-shaw*, Burmese; *Bádák*, Malay.

This is the smallest of living rhinoceroses and the most hairy, the greater part of the body being thinly clad with hair of some length, and there being hair of considerable though varying length on the ears and tail. The two horns are some distance apart at the base; both are slender above, and the anterior horn, in fine specimens, elongate and curved backwards. The skin is usually rough and granular; the folds, though much less marked than in the one-horned species, are still existent, but only that behind the shoulders is continued across the back. Incisors in adults $\frac{3}{4}$, the lower pair lateral, large, and pointed; sometimes lost in old animals.

Colour varying from earthy-brown to almost black; hair of body brown or black.

Dimensions. Somewhat variable. The type of *R. lasiotis* was 4 ft. 4 in. high at the shoulder, and 8 feet long from snout to root of tail; its weight about 2000 lbs. (*Anderson*). An old female from Malacca was only 3 ft. 8 in. high. The average height of adults is probably

4 feet to 4 feet 6 in. The largest known specimen of the anterior horn measures 32 inches over the curve. Skull 20 inches in basal length, 11·25 in zygomatic breadth.

Varieties. Specimens from Chittagong and Malacca were living at the same time in the Zoological Society's Gardens, London, in 1872; and the former was distinguished by Selater as *R. lasiotis* on account of its larger size, paler and browner colour, smoother skin, longer, finer, and more rufescent hair, shorter and more tufted tail, by the ears having a fringe of long hair but being naked inside, and above all by the much greater breadth of the head. Unquestionably the differences are considerable; but by far the most remarkable—the shape of the head—was shown by Blyth to be variable in both *R. unicornis* and *R. sondaicus*, for he figured and described a broad and a narrow type of each (J. A. S. B. xxxi, p. 156, pls. i–iv) as well as of *R. sumatrensis*. The other distinctions scarcely appear to me of specific value, and I am inclined to regard the two forms as varieties only.

Distribution. Rare in Assam, though one specimen has been recorded on the Sankosh river, in the Bhutan Duars (P. Z. S. 1875, p. 566). Another was shot 20 miles south of Comillah in Tipperah in February 1876 (P. Z. S. 1877, p. 269). From Assam the species ranges to Siam, the Malay Peninsula, Sumatra, and Borneo.

Habits. Very similar to those of the other species; this rhinoceros inhabits forests and ascends hills to a considerable elevation, having been observed 4000 feet above the sea in Tenasserim by Tickell. This is a shy and timid animal, but easily tamed even when adult.

Details obtained by Mr. Bartlett concerning a young animal born in London, induced him to regard the period of gestation as probably a little over 7 months (P. Z. S. 1873, p. 104). This differs greatly from Hodgson's account of the period in *R. unicornis* (P. Z. S. 1834, p. 98), but no details are furnished in the case of the last-named species, whilst the evidence is stated in that of *R. sumatrensis*. Still, for so large and apparently so long-lived an animal, 7 months of uterine life is short.

Anderson, in his 'Fauna of Mergui and its Archipelago,' i, p. 333, mentions his having heard of a two-horned rhinoceros seen swimming in the sea, near High Island in the Archipelago. Probably all rhinoceroses are good swimmers. The story of the Chittagong rhinoceros that was unable to swim (P. Z. S. 1872, p. 494) must be, I think, a mistake. The account given by Mason and repeated by Blyth, of this or any rhinoceros attacking fire, should be received with great caution. To my personal knowledge, Mr. Blyth's principal informant had a weakness for relating "shikar stories," which were frequently good, but not always authentic.

Family TAPIRIDÆ.

Genus **TAPIRUS**, Brisson (1766).

The last and least specialized family of surviving Perissodactyle Ungulates again consists of a single genus, having four toes on each fore, and three on each hind foot. The general form is heavy, the limbs short and stout, the tail short, the ears oval, the eyes small, and the nose and upper lip produced into a snout or short proboscis.

The skull is compressed laterally and is rather high. There are no true postorbital processes. The anterior opening of the nares is very large; the nasals are short, triangular, pointed in front, and widely separated from the premaxillaries.

Dentition: i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{3-3}$, m. $\frac{3-3}{3-3}$. The outer upper incisors are large and conical, larger than the canines. Molars and premolars bilophodont, having the crowns mainly composed of two transverse ridges.

Vertebrae: C. 7, D. 18, L. 5, S. 6, C. about 12. The ulna and fibula distinct and complete.



Fig. 156.—Crowns of (a) upper and (b) lower second right true molars of *Tapirus indicus*, the inner side uppermost.

One species, the largest of the genus, is Malayan and occurs in Tenasserim. All other living forms are Central- or South-American. Remains of several extinct species have been discovered in Europe, of one in China, and of one rather doubtful form in Burma.

337. *Tapirus indicus*. *The Malay Tapir*.

Tapirus indicus, Cur., Desmarest, *Nouv. Dict. d'Hist. Nat.* xxxii, p. 458 (1819); W. Selater, *Cat.* p. 198.

Tapirus malayanus, Raffles, *Tr. L. S.* xiii, p. 270 (1822); Cantor, *J. A. S. B.* xv, p. 263; Blyth, *Cat.* p. 135; id. *Mam. Birds Burma*, p. 49.

Tapirus bicolor, Wagner, Schreb. *Säugeth.* vi, p. 400 (1835).

Tara-shu, Burmese; *Kuda Ayer*, Tenu, Malay.

Colour. The body behind the shoulders, including the rump and upper part of the thighs, white or greyish white, tips of the ears the same; head, limbs, and fore part of body black or dark brown.

The young at first are velvety black or brownish black, with spots and longitudinal streaks of brownish yellow on the sides and of white below. This coloration changes into that of the adult between 4 and 6 months after birth.

Dimensions. Height at shoulder 3 ft. to 3 ft. 6 in., at rump 4 inches higher; length from nose to tail, over curves, 8 feet. A skull measures 15.75 inches in basal length by 8 in zygomatic breadth.

Distribution. The Malay Peninsula, extending north in Tenasserim as far as about N. lat. 15°; also Sumatra.

Habits. The Malay tapir is a shy, mild, and gentle creature, inhabiting the wilder forests, and, it is said, avoiding inhabited tracts. It is nevertheless, when captured, easily tamed. It is fond of water, and is said to plunge in and walk along the bottom, instead of swimming.

Suborder *ARTIODACTYLA*.

By far the majority of living Ungulates belong to this suborder, which comprises all the Ruminants together with the hippopotami and pigs.

The digits are even in number, either 2 or 4 on all feet, and the 3rd and 4th digits are subequal. No third trochanter on the femur. Dorsal and lumbar vertebræ together always 19. No alisphenoid canal. Nasal bones not expanded behind. Premolar and molar teeth usually dissimilar, the former with a single lobe, the latter bilobed or trilobed. Last lower molar, with very few exceptions, trilobed. Stomach almost always more or less complex. Cæcum small. Placenta diffused or cotyledonary. Mammæ inguinal or abdominal.

A. No upper incisors. Ruminant.

- a. Horns generally present in males, sometimes in females; second and fifth digits incomplete, the metapodials rudimentary or absent.

PECORA.

- a'. Horns permanent, a corneous sheath on a bony core

Bovidæ.

- b'. Horns permanent, covered with hairy skin; lateral digits wanting

Giraffidæ (Africa).

- c'. Horns branched, deciduous, but on unbranched bony cores

Antilocapridæ (America).

- d'. Horns solid, deciduous, generally branched, no cores

Cervidæ.

- b. No horns; second and fifth digits complete..

TRAGULINA. Tragulidæ. „

- Upper incisors present.
- a. Selenodont. Ruminant.*.....
- Lateral digits wanting
- b. Bunodont. Non-ruminant*
- a'. Snout elongate, with a terminal flat disk containing nostrils; feet narrow, outer digits not reaching ground.*
- a''. Toes 4—3*
- b''. Toes 4—4*
- b'. Snout broad, hairy, no terminal disk; feet short, broad, outer digits reaching ground*
- TYLOPODA.**
Camelidæ.
SUINA.
- Dicotylidæ**
(America).
Suidæ.
- Hippopotamidæ**
(Africa).

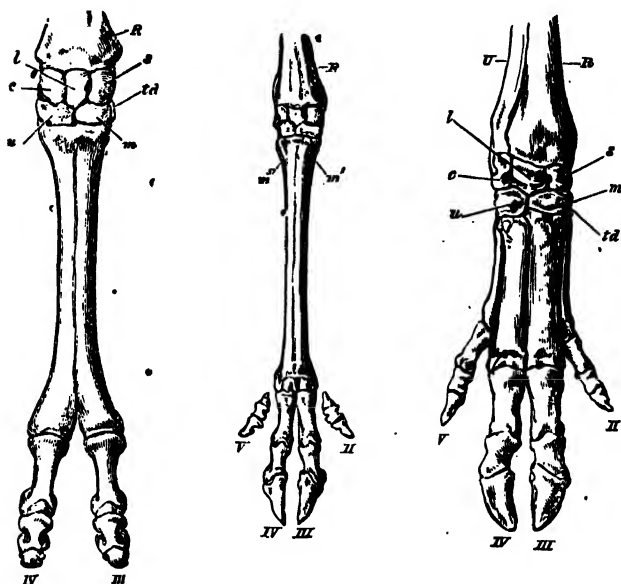


Fig. 157.—Bones of the right fore foot in:—*a.* Camel (*Camelus bactrianus*), *b.* Red Deer (*Cervus elaphus*), *c.* Pig (*Sus scrofa*).—*U*, ulna; *R*, radius; *II*, *III*, *IV*, *V*, second, third, fourth, and fifth digits; *c*, euneiform; *l*, lunar; *s*, scaphoid; *u*, unciform; *m*, magnum; *td*, trapezoid; *m*², *m*³, rudimentary second and fifth metacarpals. (Flower's 'Osteology of the Mammalia'.)

There are a few terms used in describing the genera and species of Artiodactyle Ungulates that require explanation.

The *muffle* or *rhinarium* is the naked moist area between and around the nostrils.

The *suborbital glands* are situated in front of the eye, and each has a circular or longitudinal orifice termed by some "eye-pit." Generally, when the gland is present, there is a corresponding

hollow, sometimes of large size, in the surface of the skull, on the inner anterior side of the orbit. This depression is the *lachrymal fossa*.

The *inguinal glands* are in the hollow of the groin.

The *interdigital glands* are between the large third and fourth digits, the orifice, or "foot-pit," of each being in front between the free portions of the digits.

The *lachrymal fissure* is a vacuity in the bones of the face forming the outer wall of the skull between the lachrymal and nasal.

The maximum lengths of horns in *Bovidae* and *Cervidae* are chiefly from some MS. notes kindly lent to me by Mr. A. O. Hume; from the same notes I have taken details as to localities, native names, &c. I have also made use of a list of maximum measurements of horns published by Mr. W. L. Scater in the 'Asian' of 1891, pp. 197, 217, and 232, and republished in pamphlet form; and of some notes for which I am indebted to Colonel J. Biddulph and Mr. R. A. Sterndale.

PECORA.

The typical Ruminants are distinguished by several well-marked characters, of which the following are the most important. There are no premaxillary teeth. The dental formula is almost invariably $i. \frac{0}{0}, c. \frac{0}{1-1}, pm. \frac{3-3}{3-3}, m. \frac{3-3}{3-3}$; the lower canines precisely resembling the incisors and in contact with them. The molars are selenodont, that is they have crescent-shaped tubercles on the unworn crown and show crescentic patterns after wear. Third and fourth metapodials (metatarsals and metacarpals) confluent, forming "cannon-bones." Outer or lateral toes small or sometimes wanting; their metapodial bones never complete. Navicular and cuboid bones of tarsus united. Horns or antlers generally present, at least in the male sex. Stomach with four complete cavities. Placenta cotyledonous.

The stomach of the Pecora is more complicated than that of the other Ruminants, the camels and chevrotains, and comprises four well-defined cavities, whereas in the Tylopoda and Tragulina there are only three. The four cavities are known as:—(1) The rumen or paunch, much the largest, which has its mucous lining membrane closely covered with villi, resembling the pile on velvet; (2) the reticulum or honeycomb-bag, with the lining membrane arranged in shallow hexagonal cells; (3) the psalterium or manyplies, the inner surface of which is composed of numerous longitudinal folds; and (4) the abomasum or reed, which is the digestive stomach proper. The food when swallowed is received in the paunch, and after being retained there for a time, and undergoing a softening process, it is regurgitated into the mouth, where it undergoes the process known as "chewing the cud" and consisting of trituration by the molar teeth.

Family BOVIDÆ.

Horns permanent (non-deciduous), in the majority of the genera present in both sexes, and each composed of a bony core, containing numerous air-cells, encased in a horny sheath. No upper canines. Molars frequently hypsodont. The lateral digits always imperfect, sometimes entirely absent, but generally they are either represented by the hoofs alone, or by the hoofs with a very rudimentary skeleton, the phalanges replaced by irregular nodules



Fig. 158.—Crowns of (a) upper and (b) lower second right molars of *Bos gaurus*, the inner side uppermost.

of bone. The distal ends of the lateral metapodials wanting. A gall-bladder almost always present. Placenta with numerous cotyledons.

The *Bovulæ*, or hollow-horned Ruminants (*Cavicornia*), are a very extensive family, containing all cattle, goats, sheep, and true antelopes, and they are distributed throughout Europe, Asia, Africa, and North America. The following genera occur within Indian limits :—

- | | |
|---|-------------|
| A. Horns smooth, or closely, irregularly, and transversely wrinkled. | |
| a. Horns in both sexes, not differing much in size; inserted far apart, at extremities of vertex. Size of animal large | Bos. |
| b. Horns in both sexes, inserted near together. | |
| a'. Horns large in males, small in females. | |
| a''. Males inodorous: horns curved at sides of head | Ovis. |
| b''. Males odorous: horns ascending, spiral or scimitar-shaped | Capra. |
| b'. Horns small (not longer than head) in both sexes and not differing much in size. | |
| a''. Males odorous: horns angulate in front .. | Hemitragus. |
| b''. Males inodorous: horns not angulate. | |
| a ³ . Suborbital glands present | Nemorhædus. |
| b ³ . No suborbital glands. | Cemas. |
| c. Horns in males only, not so long as head. | |
| g'. Size large: male with 2 horns; a long tail .. | Boselaphus. |

- δ'. Size small: generally 4 horns in male; tail short TETRACERUS.
 B. Horns with prominent rings at subequal intervals.
 a'. Horns much longer than head; females hornless.
 a''. Horns spiral; muzzle fine ANTILOPE.
 b''. Horns nearly straight; muzzle swollen.... PANTHOLOPS.
 b'. Horns scarcely longer than the head; females sometimes with horns..... GAZELLA.

Genus **BOS**, Linn. (1766).

Syn. *Bubalus* and *Bison*, H. Smith (1827); *Bibos*, Hodgs. (1837); *Poëphagus*, Gray (1843); *Gavæus* and *Syncerus*, Hodgson (1847).

Size large. Body massive and limbs stout. Tail long, usually tufted at the end. Muzzle naked, large and broad. No suborbital, inguinal, or interdigital glands. Mammary 4.

Horns in both sexes, not differing greatly in size, smooth or nearly so; inserted, far apart, on each extremity of the vertex of the skull, spreading more or less outwards at first, then curving upwards. The surface of the skull behind the horns makes an angle rather less than a right angle with the face. Molars very hypsodont. Vertebrae: C. 7, D. 13-14, L. 6-5, S. 5, C. 15-18.

By many modern writers the animals here referred to the genus *Bos* have been distributed amongst several genera. The distinctions between the latter, however, are scarcely of generic rank. The principal subdivisions are the typical or taurine, comprising *Bos gaurus* and *B. sondaicus*, the bisontine, including *B. grunniens*, and the bubaline, to which *B. bubalus* belongs.

Indian fossil oxen are numerous, at least 3 Pleistocene and 10 Pliocene forms having been described. The most important are the Pleistocene *B. namadicus*, somewhat allied to *Bos gaurus*, but with much larger horns, ancestral forms of the gaar and buffalo, and a Pliocene bison, *B. sivalensis*.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Horns round or oval in section.
 a. No fringe of long hair on sides; a raised dorsal ridge.
 a'. No white on back of thighs.
 a''. Horns turned inwards near the tips . . . *B. gaurus*, p. 484.
 b''. Horns spreading, not turning inwards . . . *B. frontalis*, p. 487.
 b'. A large white disk on back of thighs *B. sondaicus*, p. 489.
 b. A fringe of long hair on sides; no dorsal ridge *B. grunniens*, p. 490.
 B. Horns trigonal or subtrigonal *B. bubalus*, p. 491.

The common domestic humped cattle of India, *Bos indicus*, belong to a species differing in structure, general coloration, voice, and habits from the tame animal of Europe and Northern Asia, *B. taurus*. The origin of *B. indicus* (sometimes called Zebu by European naturalists) is unknown, but was in all probability

tropical or subtropical, and was regarded by Blyth as probably African. No ancestral form has been discovered amongst Indian fossil bovines, which, as already mentioned, comprise species allied to the gaur and buffalo. Humped cattle have run wild at times in many parts of India (Oudh, Rohilkund, Surat, Mysore, Nellore, Char Sidhi, at the mouth of the Megna, &c.: see Blyth, J. A. S. B. xxix, p. 288, and Jerdon, Mam. p. 301).

338. *Bos gaurus*. *The Gaur*.

Gour, *Trail, Edinb. Phil. Jour.* xi, p. 334 (1824).

Bos gaurus, *Ham. Smith, Griffith's Cuv. An. Kingd.* iv, p. 309 (1827); *Evans, J. A. S. B.* vi, p. 223, pl. xvi; *Elliot, J. A. S. B.*

x, p. 579; *Blyth, J. A. S. B.* xi, p. 444, xxi, p. 433, xxxi, p. 336; *id. Mam. Birds Burma*, p. 47; *W. Blanford, P. Z. S.* 1890, p. 592, pl. xlix; *W. Sclater, Cat.* p. 124.

Bos gour and *B. gayæus*, *Hardwicke, Zool. Jour.* iii, p. 233 (1828). *Bibos subhemachalus*, *Hodgson, J. A. S. B.* vi, p. 499 (1837).

Bibos cavifrons, *Hodgson, J. A. S. B.* vi, p. 747 (1837), x, p. 449, pl. xvi, p. 706; *Blyth, J. A. S. B.* xi, p. 588; *Elliot, Mad. Jour. L. S.* x, p. 227; *Horsfield, Cat.* p. 181.

Bos gour, *Cantor, J. A. S. B.* xv, p. 272. *Bibos asseel*, *Horsfield, Cat.* p. 181 (1851).

Gaviæus gaurus, *Blyth, J. A. S. B.* xxix, p. 282; *id. Cat.* p. 161; *Jerdon, Mam.* p. 301.

Gaur, *Gauri-gai*, H.; *Gâyâl*, in Orissa, &c.; *Gaor* ♂, *Gaib* ♀, in Chutia Nâgpur (commonly *Ban-boda*, *Ban-parra*, *Ran-hila*, *Ran-pado*, *Jangli-khulga*, and even *Ban-bhainsa* and *Arna*, all signifying wild buffalo, in various parts of the Peninsula); *Sainat*, Ilokol; *Gaviya*, Mahr.; *Pera-mao*, Gond, in the South; *Katu-erimai*, Tam.; *Karkona*, *Karti*, *Kard-yenné*, *Kard-korna*, *Doddu*, Can.; *Karthu*, *Paothu*, Mal.; *Mitham*, Assam; *Seloi*, Chittagong; *Pyoung*, Burmese; *Saladang*, Malay. The *Bison* or *Indian Bison* of European sportsmen.

General form massive; body deep, limbs and hoofs small. Ears large. A high ridge along the anterior half of the back terminating abruptly about halfway between the shoulder and the tail, and caused by the spinous processes of the dorsal vertebræ being long and those of the lumbar vertebræ short, the change in length taking place suddenly. Skull bearing a high ridge, convex on the vertex between the horn-cores; in front of this ridge the forehead is deeply concave. Horns considerably flattened towards the base, curved throughout; the tips turned inwards and slightly backwards. Thirteen pairs of ribs. Tail just reaching the hocks. No distinct dewlap. Hair short, very thin on the back in old bulls.

Skulls from the Duars of Bhutan, the Mishmi hills, and the Malay Peninsula are much broader in proportion across the forehead than those from the Indian Peninsula; but I cannot say whether the broad-headed type is alone found east of the Bay of Bengal. I think not. There is in the fine collection presented by Mr. Hume to the British Museum a very broad skull from Salem,

South India. The only Mishnî skull I have seen, one in Mr. Hume's collection, has the vertex arched and the forehead broad, but wants the frontal concavity, and thus shows a tendency towards *B. frontalis*. The horns in all these heads have the normal curve of the gaur (see fig. 159, p. 488).

Colour. Brown, almost black in old males, less dark and sometimes more rufous in females and young males, especially during the cold season, and in those inhabiting drier parts of the country, where there is less shade. Lower parts rather paler, hair about axil and groin golden brown. Legs from above the knees and hocks to the hoofs white. Head from above the eyes to the nape ashy grey, becoming in some animals whity-brown or dirty white. Muzzle pale-coloured. In calves, according to Blyth, there is a dark stripe down the back. Horns pale greenish or yellowish, with black tips.

Dimensions. This appears to be the largest of existing bovines. Large bulls are said to exceed 6 feet in height at the shoulder, but this is rare and exceptional, 5 ft. 8 in. to 5 ft. 10 in. being the usual height. Cows are much smaller, about 5 ft. high. A huge bull measured by Elliot was 6 ft. 1½ in. high, 9 ft. 6 in. from nose to root of tail, tail 2 ft. 10 in. long, girth behind shoulders 8 ft. A cow 4 ft. 10½ in. high measured 7 feet from nose to rump over curves, and 6 ft. 9 in. in girth. A large male skull from the Western Ghats measures 18 inches in basal length and 9·9 in zygomatic breadth. Average male horns measure 20 to 24 inches round the outside curve. Horns from Travancore have been recorded 39 inches in length and 19 inches in girth at the base; whilst other Travancore horns measure 20·75 in girth, and a pair from the Malay Peninsula 22, though only 32 long. Large cows' horns measure 23 and 24 round the outside curve, with a girth of 13·25. The girth of each horn in freshly killed specimens is about an inch more than in dried skulls.

Distribution. All the great hilly forest-tracts of the Indian Peninsula, Assam, Burma, and the Malay Peninsula. The eastern range of this species is not clearly known except that it is said to extend to Siam and, I believe, to Cochin China. *B. gaurus* does not exist in Ceylon nor in any of the Malay Islands; it is said, however, to have inhabited Ceylon up to the commencement of the present century*. In India at present its extreme north-western habitat is probably the Rajpipla hills, near Broach; and west of long. 80° East the river Nerbudda forms approximately, though

* Knox, writing in 1681, mentioned under the name of *Guavera* an animal kept tame at Kandy. The description of this animal corresponds with *B. gaurus*. Kelaart (Prod. p. 87), Forbes ('Journal of Eleven Years' Residence in Ceylon,' ii, p. 159), and Griffiths (Ouv. An. King. v, p. 410) also mention the *Guavera* or *Goura* as formerly inhabiting Ceylon. On the other hand, Sanderson has pointed out the improbability of the gaur having disappeared from an area where wild elephants still exist in large numbers. Nevill ('Taprobanian,' iii, p. 5) regards it as probable that the gaur formerly existed wild in Ceylon, but had been introduced by man.

not absolutely, the northern boundary of its range. It does not inhabit the grass-jungles of the Gangetic plain, except close to the Himalayas; but it is found in the forests at the foot of those mountains as far west as Nepal. South of the Ganges it exists in suitable tracts in Chutia Nágpur, Orissa, and the northern Circars, the Central Provinces, Hyderabad territories, Mysore, and throughout the Western Gháts, wherever it has not been exterminated or driven away.

Habits. Excellent accounts are given by Elliot (*l. c.*), Forsyth ('Highlands of Central India'), Sterndale (*Nat. Hist. Indian Mam.* and 'Seonce'), Hornaday ('Two Years in the Jungle'), J. D. Inverarity (*Jour. Bombay N. H. Soc.* iv, p. 294), and above all by Sanderson ('Thirteen Years &c.'). Hodgson's description is evidently from native reports and is untrustworthy; whilst Col. Campbell's delightful stories in 'The Old Forest Ranger,' though quoted with approval by many writers, must, I fear, be regarded as works of imagination.

The gaur keeps to forest or high grass, generally but not always near hills, and is found in herds of from five or six to about 20, or occasionally more. Bulls often wander by themselves, and the finest and oldest bulls are said always to occur solitary; still very large bulls are found with herds, and young bulls are frequently seen alone, or two or three together. All are shy and avoid cultivated tracts as a rule, though instances occur in wild parts of the country of gaur feeding on growing crops. Their food consists chiefly of grasses; they do not commonly browse, though they occasionally eat the leaves and even the bark of particular trees, and they are fond of the shoots of bamboos. They feed generally in the early morning and evening, and lie down to rest from about 9 A.M. to about 4 P.M., and at night. They drink as a rule in the afternoon.

These bovines inhabit the hills of the Indian Peninsula to an elevation of 5000 or 6000 feet, or occasionally even higher; but they do not ascend the Himalayas to nearly the same extent. They are admirable climbers, and ascend or descend steep hills with wonderful facility. They are timid animals, but in wild places, where they are rarely subject to attack and disturbance, they are by no means remarkably wary. Wounded animals occasionally charge, and solitary bulls have been known to attack without provocation; but the tales of the gaur's ferocity recorded by some sportsmen are not confirmed by any of the later writers who have had good opportunities of studying the animals. A bull gaur is one of the noblest animals in the world, a model of strength and symmetry, and his formidable appearance has led to his being unjustly credited with a savage disposition.

The period of gestation is not known with any certainty. Breeding is said to take place in the cold season. The calves are mostly born (in the Peninsula of India) in August or September, a few early in April, May, or June. Gaur suffer from the same diseases as domestic cattle.

In India all attempts at domestication of this bovine have been failures. The calves appear always to die in captivity, none it is said having been known to attain their third year. But there can be little doubt that the gaur has been tamed and kept tame in some of the hill-tracts between Assam and Burma (see also under *B. frontalis* on the next page); and quite recently a young male animal, now nearly four years old, has been brought to England from Pahang, in the Malay Peninsula, and is still (1891) living in the Zoological Gardens, Regent's Park.

According to Sanderson, three distinct sounds are uttered by this species. The first is a sonorous bellow, used as a call, and unlike any of the usual bovine sounds. The second is a low "moo," indicative of apprehension or curiosity. The third is the well-known whistling snort of alarm with which the animal dashes off when frightened. I have heard the tame animal in the Regent's Park utter a prolonged call, not very unlike the lowing of *Bos taurus*, but utterly unlike that of *B. indicus*.

339. *Bos frontalis*. *The Gyal or Mithan*.

Bos frontalis, Lambert, *Tr. L. S.* vii, pp. 57, 302, pl. iv (1804); Griffith, *J. A. S. B.* viii, pp. 211, 281; Blyth, *J. A. S. B.* xxxi, p. 338; *id.* *Mam. Birds Burma*, p. 48; Sclater, *P. Z. S.* 1866, p. 1, pl. i; J. Sarbo, *P. Z. S.* 1883, p. 142; W. Blanf. *P. Z. S.* 1890, p. 593, fig. 2; W. Sclater, *Cat.* p. 126.

Bos gaurus, Colebrooke, *As. Res.* viii, p. 488, pl. (1805); Hodgson, *J. A. S. B.* x, pp. 453, 470, pl.

Bos sylhetanus, F. Cuvier, *Hist. Nat. Mam.* pls. 418, 419 (1824).

Gaurus frontalis, Hodgson, *J. A. S. B.* xvi, p. 705; Horsfield, *Cat.* p. 179; Blyth, *J. A. S. B.* xxix, p. 291; *id.* *Cat.* p. 162.

Gáyál, H.; Mithan, *Bunerea-goru*, Gavi or Gabi, Assam and Chittagong; Sandung, Manipuri; Shel, Shio, Kuki; Jhongnua, Mugh; Bui-sang, Hui, Naga; Phu, Aka; Sibú, Daphla; Nuni, Tsainy, Burmese.

Very similar to *B. gaurus* but smaller, with proportionally shorter limbs, somewhat less developed dorsal ridge, a well-marked dewlap, and very different skull and horns, as shown in the accompanying figures (p. 438). The head is shorter, with shorter nasals, the forehead quite flat, and the transverse outline of the vertex between the horn-cores straight, not arched. The horns are much less curved, in fact nearly straight, spreading outwards and directed more or less upwards at the tips, but not inwards.

Colour very similar to that of *B. gaurus*. Head and body dark brown in both sexes, legs from above the knees and hocks white or yellowish. Many tame individuals are mottled and some are white throughout. Horns blackish throughout.

Dimensions. Considerably less than in *B. gaurus*, especially in height. The skull of an old bull known to be that of a wild animal measures 16·2 inches in basal length, 8·5 in breadth across the orbits, length of nasals 6·5, length of horn 14, girth at base the same. I have seen much longer horns on a tame animal.

Distribution, &c. The history and range of this animal are

singularly obscure. *Bos frontalis* was described by Lambert and Colebrooke as occurring both in the tame and wild state in the hills of Tipperah amongst the Kukis; and Lambert gave a detailed account, furnished by Mr. McRae, of the capture of wild animals and their domestication by these tribes. It has since been ascertained that tame "mithans" or "gayals" are found in possession



Fig. 159.—Skull and horns of *Bos gaurus*.



Fig. 160.—Skull and horns of *Bos frontalis*.

of particular tribes "both north and south of the Assam valley, around Manipur and Cachar, and in the Tipperah, Chittagong, and Lushai hills as far south as the neighbourhood of Chittagong. But the wild bovine of the area in general was ascertained by Blyth, Sarbo, Anderson, and others to be *Bos gaurus*. The later evidence is confusing. Peel ('Nature,' Nov. 5th, 1885, p. 7) states that both wild and tame animals are called *Mithan* in Upper Assam, that they are perfectly distinct, and no intermediate forms ever occur; whilst Sanderson ('Thirteen Years &c.,' p. 250) declares that in Chittagong the two forms, wild and tame, are similar. Lastly, Mr. E. C. Stuart Baker ('Asian,' March 6th, 1891, p. 358), in the North Cachar hills confirms the old story of the wild mithans being reclaimed and domesticated by the Kukis.

Much confusion has doubtless arisen from the terms Mithan and Gayal being used for both *B. frontalis* and *B. gaurus* (Gayal is a word of Sanscrit derivation applied to *B. gaurus* in parts of India, and not used by the Indo-Chinese tribes who alone own *B. frontalis*). But it is very probable that some of the domesticated "mithans" are *B. gaurus*, the domestication of which by the Kukis was described by Blyth on information from a missionary, M. Barbe (J. A. S. B. xxix, p. 294). This would explain the old accounts of Mr. McRae and the recent one by Mr. Baker, both of which have every appearance of authenticity.

Until quite recently there were grounds for supposing that the wild "mithan" of the mishmi hills, Upper Assam, might be *Bos frontalis*, but, as already mentioned under *Bos gaurus*, this appears not to be the case. A few days before these pages were sent to press, I saw, in Mr. Hume's private collection, a typical skull of *B. frontalis*, obtained by Mr. W. Davison in Tenasserim, and distinctly identified by him as that of a wild animal killed in Tenasserim, between Lemyne, 66 miles south by east of Moulmein, and Tenasserim town. This is, I believe, the first distinct record of the occurrence of *B. frontalis* in the wild state. The range of the species is still a question to be solved.

The tame herds of *B. frontalis* are kept for food, and according to some authorities for their milk, though this is doubtful, as most of the Indo-Chinese tribes who keep mithans never drink milk. The animals appear never to be employed in agricultural labour, nor as beasts of burden. They roam and feed unattended through the forest during the day, and return to their owner's village at night. They breed at times freely with the common humped cattle, and the progeny has been crossed with other bovines (Bartlett, P. Z. S. 1884, p. 399). The period of gestation is said by one writer to be ten months, by another eleven, but further information on this point is desirable.

340. *Bos sondaicus*. *The Banting*.

Bos sondaicus, Müller & Schleg. *Verhandl.* p. 197, pls. xxxv-xxxix (1839); Blyth, J. A. S. B. xi, p. 445, xxxi, p. 336; *id.* *Mam. Birds Burma*, p. 48; W. Blanford, P. Z. S. 1890, p. 593; W. Sclater, *Cat.* p. 127.

Bibos banting, Gray, *Knowsley Menagerie*, p. 48 (1850); Horsfield, *Cat.* p. 183.

Bos bantenz, Wagner, Schreb. *Säugeth. Suppl.* v, p. 473.

Gaveus sondaicus, Blyth, J. A. S. B. xxix, p. 293; *id.* *Cat.* p. 160.

Tsainy, Burmese; *Sapi-utan*, Malay.

This animal appears to be slighter than the gaur, with the legs longer in proportion and the dorsal ridge less developed. The tail descends below the hocks. The dewlap is of moderate size. The head is much more elongate, the forehead not concave, the horns smaller, cylindrical in the young, flattened towards the base in adults, and curving outwards and upwards at first, and towards the tips somewhat backwards and inwards.

Colour. Cows and young bulls have the head, body, and upper portions of the limbs bright reddish brown, approaching chestnut, old bulls are black; in both sexes the legs from above the knees and hocks, a large oval area on the buttocks, extending to the base of the tail but not including it, a stripe on the inside of each limb, the lips, and the inside of the ears are white. Calves have the outside of the limbs chestnut throughout and a dark line down the back.

Dimensions. According to S. Müller, a full-grown Javan bull measured 5 ft. 9½ in. high at the shoulder, the length of the head

and body was 8 ft. 6 in., and of the tail 3 ft. The largest Burmese specimen recorded was 16 hands high (5 ft. 4 in.). A skull from Java in the Indian Museum, Calcutta, has horns measuring 30 inches long by 17 inches in circumference at the base. This is unusually large. A male skull from Borneo in the British Museum measures 17.75 inches in basal length by 8.75 in zygomatic breadth.

Distribution. Throughout Burma and the Malay Peninsula, also in the islands of Borneo, Java, and Bali. This species is probably found also in Sumatra and Siam. It extends north to Northern Pegu and Arrakan, and probably to the hill-ranges east of Chittagong.

Habits. So far as is known, similar to those of *Bos gaurus*, except that *B. sondaicus*, from the greater proportional length of the legs, is probably less of a climber and more restricted to the plains of high grass.

The banting is domesticated in Java, and perhaps in other parts of its range.

‘341. *Bos grunniens.* *The Yak.*

Bos grunniens, *L. Syst. Nat.* i, p. 99 (1766); *W. Slater, Cat.* p. 128.

Bos poëphagus, *H. Smith, Griffith's An. King.* iv, p. 404 (1827).

Bison poëphagus, *Hodgson, J. A. S. B.* x, pp. 449, 912, xi, p. 282, xvi, p. 708.

Poëphagus grunniens, *Gray, List Mam. B. M.* p. 153 (1843); *Horsfield, Cat.* p. 184; *Adams, P. Z. S.* 1858, p. 529; *Blyth, Cat.* p. 158.

Dong, Brong-dong (wild), *Pegu* (tame), *Tibetan*; *Yak*, *Tibetan* of *Ladak* and *N. Kumaun*; *Ban-chour*, *H.*; *Kuch-gau*, *P.*; *Boku* (old ♂), *Kotass*, *Kirghiz*.

The form is massive, high at the shoulder, back nearly level, not falling away above the hips. Legs short and thick; hoofs large, rounded. Muzzle small. Ears small. No dewlap. Hair nearly smooth on upper parts and sides, very long on lower part of each side, forming a deep fringe extending across the shoulder and thigh. A tuft of long hair also on the breast. Terminal half of tail thickly covered with long hair, forming an enormous tuft, not descending in general below the hocks. Ribs 14 pairs. Head elongate. Forehead nearly flat. Horns smooth, round, slightly oval at the base in very old animals, curving outward and upward at first, then forward, then inward and upward, and slightly backward in some at the end.

Colour dark brown, almost black, throughout, with the exception of a little white about the muzzle, and a sprinkling of grey on the head and neck in old animals. Old bulls are reddish on the back.

Dimensions. According to Captain E. Smyth (*J. A. S. B.* xxx, p. 393) some bulls are nearly 18 hands (6 feet) high; the same is stated by Prejvalski and others. A bull 16½ hands (5 ft. 6 in.) high measured from horns to root of tail 7 ft. 3 in.; length of tail (with hair) 3 ft. 4 in., girth round chest 7½ feet. A bull weighs,

according to Prejvalski and Dalgleish, about 1200 lbs. Basal length of a large skull 20 inches; orbital breadth 11. Good horns measure 25 to 30 inches in length round the curve; the largest recorded is 40 long, and nearly 19 in girth at the base. Cows are considerably smaller than bulls and have smaller horns.

Distribution. The plateau of Tibet at considerable elevations, from about 14,000 or 15,000 to 20,000 feet in summer; and part of the Kansu province of China. The wild yak is only found within Indian limits in Northern Ladak, especially about Chang Chenmo.

Habits. The wild yak, according to Kinloch, ('Large Game Shooting,' ed. 2, p. 82) and Prejvalski ('Mongolia,' &c., D. Morgan's translation, ii, p. 187), inhabits the coldest, wildest, and most desolate mountains, and is found at a greater elevation than any other mammal. In summer the cows and young collect in herds of from ten to upwards of a hundred in number. Bulls are generally solitary or in small parties of 3 or 4, except in the rutting-season, when each bull separates 4 or 5 cows from the main herd and remains with them. They feed morning and evening, mainly on a rough wiry grass that grows in the high Tibetan valleys, and usually betake themselves to a steep barren hill-side, often at a great elevation, to rest during the day. They require plenty of water, and in winter eat snow. Their powers of sight and hearing are far less acute than their sense of smell. They are timid animals, but wounded yak sometimes charge, as do most bovines.

Domesticated yaks are largely kept by Tibetans and by various tribes inhabiting the higher Himalayas, for their milk, as beasts of burthen, and for food. They are smaller than wild yaks and vary in colour, many being white or piebald; the white tails are the *chowris* of India, used as fly-flaps. They rut in winter, and bear young in autumn after a period of gestation of 10 lunar months according to Hodgson. They breed freely with domestic cattle.

342. *Bos bubalus*. The Buffalo. *Bubalus bubalis* (Linn.)

Bos bubalis, *L. Syst. Nat.* i, p. 99 (1766); *W. Slater, Cat.* p. 129.

Bos arnee, *Kerr, An. King.* p. 336 (1792); *Gray, A. M. N. H.* (2) xvi, p. 230 (1855); *id. P. Z. S.* 1855, p. 17, pl. xl.

Bos buffelus, *Blumenbach, Handb. Naturgesch.* p. 121 (1821); *W. Blauf. J. A. S. B.* xxxvi, pt. 2, p. 195.

Bubalus arna, *Hodgson, J. A. S. B.* x, pp. 469, 912 (1841), xvi, p. 709; *Horsfield, Cat.* p. 179.

Bubalus buffelus, *Kelaart, Prod.* p. 87; *Blyth, Cat.* p. 163.

Bubalus arni, *Jerdon, Mam.* p. 307; *Blyth, Mam. Birds Burma*, p. 49.

Arna ♂, *Arni* ♀, H.; commonly *Arna bhainsa*, *Jangli bhains* (bhains, tame buffalo); *Mang*, Bhagalpur; *Mains*, Bengali; *Bir Biar*, Ho-Kol; *Gera erumi*, Gond; *Mi Harak*, Cingalese; *Moh*, Assamese; *Siloi*, Kuki; *Gubui*, Rili; *Ziz*, Le, Naga; *Misip*, Cachari; *Iroi*, Mahipuri; *Kyru*, Burmese; *Pana*, Karen; *Karbo*, Malay.

General form heavy, body massive, legs thick and short, hoofs large. Tail reaching the hocks (but, I think, variable in length). Ribs 13 pairs. Hair on the body very thin, especially in old animals. Muzzle large and square. Head carried very low.

Skull elongate, nasals long, forehead nearly flat. Horns very large, flattened, transversely rugose, trigonal in section, tapering slowly and gradually from the base, curving at first upward, outward, and slightly backward from the plane of the face, the curve increasing towards the ends, where the horns curve inwards and a little forwards. The horns depart but little from one plane throughout. In some (*macrocerus* of Hodgson) the horns are almost straight till near the end, where they turn more rapidly upward.

Colour throughout dark ashy, almost black. The legs are sometimes whitish; in some tame forms the legs are white to the same height as in the Gaur. Horns black.

Dimensions. According to Jerdon (who probably took the figures from Hodgson) and others, the wild buffalo measures in height up to 6½ feet, and, in length from snout to root of tail 10½. Kinloch, however ('Large Game Shooting,' ed. 2, pp. 88, 91), doubts if any exceed 5 ft. 4 in. in height (16 hands), and gives the following measurements of a good-sized bull: height 5 ft., length from nose to root of tail 9 ft. 7 in.; tail 3 ft. 11 in.; girth 8 ft. 3 in.; length of horns from tip to tip round curve 8 ft. 3 in. This is a common way of measuring buffalo horns. The longest recorded single horn known, one in the British Museum, measures 78½ inches, which would give an outside sweep of about 14 feet. Cows' horns are longer than bulls', but of less girth. Basal length of a large bull's skull 22·8 inches, orbital breadth 10·25.

Distribution. Plains of the Brahmaputra and Ganges from the eastern end of Assam to Tirhoot, and the Terai as far west as Rohilcund, the plains near the coast in Midnapore and Orissa, and also plains in the Eastern Central Provinces (Mandla, Raipur, Sambalpur, Bastar, and other districts) as far south as the Godavari and Pranhita rivers, and perhaps a little beyond. Wild buffaloes are wanting in Southern and Western India, but abundant in Northern Ceylon. Some buffaloes are also found in the wild state in Burma and the Malay Peninsula, but it is uncertain whether they are not descended from herds escaped from captivity.

Varieties. Besides the two forms, one with horns approaching a circle (*spirocerus* of Hodgson) and the other with horns nearly straight at first and turned up at the end (*macrocerus* of Hodgson), there is a very distinct race of a dun colour that inhabits Upper Assam. I have seen two heads of bulls, one in Mr. Hume's collection now in the British Museum, the other in the Indian Museum, Calcutta. These differ in the much more convex forehead, and the skull is remarkably short in front of the orbits, the nasals being shorter than the distance from their posterior end to the vertex, whilst in ordinary buffaloes they are longer. This difference is so great that the form requires a distinctive name, and may be called *Bos bubalus*, var. *fulvus*, or the dun buffalo.

Habits. The wild buffalo keeps chiefly to level ground and is generally found about swamps. It haunts the densest and highest grass-jungle or reeds, but is also found at times in open plains of short grass, or amongst low bushes, but very rarely in tree-forest. Buffaloes associate in herds, often of large size. I have seen 50 together, and have heard of much larger assemblages. They feed chiefly on grass, in the evening; at night, and in the morning (probably morning and evening as a rule), and lie down, generally in high grass, not unfrequently in a marsh, during the day; they are by no means shy, nor do they appear to shun the neighbourhood of man, and they commit great havoc amongst growing crops. Sometimes a herd or a solitary bull will take possession of a field and keep off the men who own it. In fact buffaloes are by far the boldest and most savage of the Indian *Bovidae*, and a bull not unfrequently attacks without provocation, though, probably on the principle that a council of war never fights, a herd, although all will gallop to within a short distance of an intruder and make most formidable demonstrations, never, I believe, attacks anyone who does not run away from them. A wounded animal of either sex often charges, and has occasionally been known to knock an elephant down. Buffaloes retain their courage in captivity, and, as mentioned already (*ante*, pp. 63, 67), a herd will attack a tiger or other dangerous animal without hesitation, and, although gentle with those they know and greatly attached to them, they are inclined to be hostile to strange men and strange animals. Whether wild or tame they delight in water, and often during the heat of the day lie down in shallow places with only parts of their heads above the surface.

Few, if any, tame animals have changed less in captivity than buffaloes. Unlike the yak and gayal, they never breed with tame cattle (*B. indicus*), although the cows often pair with wild bulls of their own species. Tame buffaloes are chiefly kept for milk and for draught. They have been introduced throughout many of the warmer parts of the Old World, and even in Italy, whither they were brought in the sixth century (Griffith's Cuvier, iv, p. 381). Both wild and tame rut in autumn; the females gestate for 10 months (10 months and 10 days according to some), and bear one or two young in summer.

Genus **OVIS**, Linn. (1766).

Syn. *Ammotragus*, Blyth (1840); *Pseudois*, Hodgson (1846); *Caprovis*, Hodgson (1847).

Tail short in all wild Asiatic forms. Suborbital gland and lachrymal fossa usually present (wanting in *O. nakura*). Interdigital glands present on all feet. Inguinal glands present. No muffle. No beard on chin, but frequently long hair on neck. *Mammæ* two. Males non-odorous.

Skull broadest at the orbits, which are prominent, and narrowing suddenly in front of them; the frontal and occipital planes, the

latter including the parietal region, meeting at about a right angle, Occipital plane very flat. Horns in both sexes, very large in males, much smaller in females; in the former thick, sometimes very thick at the base, tapering regularly, and forming a circular or spiral curve at the side of the head (*O. nahura* is an exception). Vertebra: C. 7, D. 13, L. 6, S. 4, C. 10-14.

Wild sheep are found in the Palearctic and Nearctic regions, one species ranging into Sind and the Punjab. The structural differences from the genus *Capra*, comprising the true goats, are very small, and one species, *O. nahura*, is absolutely intermediate. Both inhabit mountains and high plateaus, but the sheep keep more to open undulating ground, the goat to crags and precipices. The flesh of all wild sheep is excellent, the males never having the rank odour that is characteristic of goats.

The period of gestation in different breeds of European tame sheep varies from 144 to 150 days, but, according to Hodgson, in several Himalayan and Tibetan breeds the period is 160 (J. A. S. B. xvi, pp. 1010 &c.). The origin of tame sheep is quite unknown.

Synopsis of Indian Species.

- A. Normal; suborbital glands present, horns with a circular or spiral curve.
 - a. Very large; adults exceeding 42 inches in height at shoulder.
 - a'. Horns in male never exceed one circle *O. hodgsoni*, p. 494.
 - b. Horns in male considerably exceed a circle. *O. poli*, p. 496.
 - b. Size moderate; adults not exceeding 36 inches in height *O. vignei*, p. 497.
- B. Abnormal; no suborbital glands, curve of horns S-shaped *O. nahura*, p. 499.

343. *Ovis hodgsoni*. *The great Tibetan Sheep.*

Ovis nayaur, Hodgson, *As. Res.* xviii, pt. 2, p. 135 (1833), *partim*.

Ovis hodgsoni, Blyth, *P. Z. S.* 1840, p. 65; *id.* *A. M. N. H.* vii, p. 190 (1841); *Sclater*, *P. Z. S.* 1860, p. 129; *V. & B. Brooke*, *P. Z. S.* 1875, p. 520; *W. Sclater*, *Cat.* p. 136.

Ovis ammonoides, Hodgson, *J. A. S. B.* x, p. 230, pl. i, fig. 1 (1841); xv, p. 338, with 3 plates; *Hutton*, *J. A. S. B.* xvi, p. 568.

Ovis ammon, Horsfield, *Cat.* p. 176; *Blyth*, *Cat.* p. 177; *Blanford*, *J. A. S. B.* xli, p. 40, *nec* *Capra ammon*, L.

Caprovis argali, Adams, *P. Z. S.* 1858, p. 527, *nec* *Ovis argali*, Pallas.

Nyan ♂, *Nyanmo* ♀, Ladak; *Nyang*, *Nyang*, *Hyan*, Tibetan.

Hair short, coarse, and very close. Ears short. Tail very short. In adult males the hair on the sides and lower surface of the neck is lengthened into a white ruff, and there is a dark crest of hair, not so long as the ruff, along the back of the neck to the withers.

Horns in male very massive, coarsely wrinkled transversely, subtriangular in section, but with the edges, especially the fronto-orbital, much rounded, the orbital and nuchal surfaces very much broader than the frontal. The curve is a spiral, the two horns

diverging very slowly, tips turned very little outwards, and the whole curve of each horn not equal to a complete circle. In females the horns are short, erect, curved backwards and outwards, thin and strap-like towards the ends.

Colour greyish brown above, paler and whitish below. In males the caudal disk surrounding the tail, the rump, throat, chest, belly, and insides of the legs are white, crest and a stripe down the front of each leg dark. Old males are grizzled on the back, white hairs being mixed with the brown of the upper parts. A dark mark above the tail. Females have little or no mane, the white is less pure, and the caudal disk is indistinct. The colour in winter is probably paler than in summer.

Dimensions. Height of old rams at shoulder $3\frac{1}{2}$ to 4 feet, females not much less. Length from nose to rump (skins), males 6 to $6\frac{1}{2}$ feet, females $5\frac{1}{2}$; tail without hair 1 inch, with hair 3; ear 6; basal length of male skull 13, breadth at orbits 7.5. Horns of adult males are 36 to 40 inches long round the curve, and the girth at the base is 16 to 17. The greatest recorded measurements are said to be, length 53, basal girth 24 or perhaps 25, but there appears a little doubt about these. 48 inches in length and 20 in girth have certainly been measured. Female horns are said to attain 24 inches in length, but rarely exceed 18.

Distribution. The plateau of Tibet from Northern Ladak to the country north of Sikhim and probably farther east. This sheep does not range south of the main Himalayan axis; it is not found in summer below about 15,000 feet elevation; in winter it may descend to about 12,000 in places.

Habits. This magnificent sheep, probably the largest of the genus, inhabits the bare undulating Tibetan plateau in herds, keeping to open valleys and low stony slopes. In summer the rams are found in small parties of from 3 or 4 to about 15, apart from the ewes. The rutting-season is in winter; at this time the great sheep inhabit the lower and more sheltered Tibetan valleys. The young are born about May or June.

No animal is more wary. Owing to its watchfulness, its keen sight and acute sense of smell, its speed when on foot, and the open character of the ground it haunts, the great Tibetan sheep is one of the most difficult of all animals to stalk or shoot.

Ovis trookei (P. Z. S. 1874, p. 143; 1875, p. 521) has now been ascertained to be a wild hybrid between a male *O. hodgsoni* and female *O. vignei* (Sterndale, Jour. Bombay N. H. Soc. i, p. 35, and P. Z. S. 1886, p. 205)—a male of the great sheep in Zaskar, having taken possession of a small flock of *O. vignei* ewes, and bred with them. The converse, a hybrid between the male *O. vignei* and female *O. hodgsoni* has also been shot by Major C. S. Cumberland (P. Z. S. 1885, p. 851). The hybrid in the latter case was found with a flock of *O. hodgsoni*.

Ovis ammon, L. sp. (*O. argali*, Pall.), inhabits plateaus in Northern Mongolia, and perhaps in Southern Siberia. It is nearly allied to *O. hodgsoni*, but appears to have no ruff.

344. *Ovis poli*. *The great Pamir Sheep.*

Ovis poli, Blyth, P. Z. S. 1840, p. 62; *id.* A. M. N. H. vii, p. 195, pl. v, figs. 1, 2, 3, 4; *Stoliczka*, P. Z. S. 1874, p. 425, pl. liii; *Biddulph*, P. Z. S. 1875, p. 157; *id.* P. A. S. B. 1879, p. 280; *Scully*, P. Z. S. 1881, p. 200; *Blanford*, P. Z. S. 1884, p. 326; *W. Sclater*, Cat. p. 133.

Ovis poli and karelini, *Servtzeff*, Turk. Jev. pp. 84-102, 149, pls. i-vi (1873); *id.* A. M. N. II. (4) xviii, pp. 171, 210, 217, 220 (1876); *V. & B. Brooke*, P. Z. S. 1875, pp. 512, 514; *Blanford*, Yark. Misq., Mam. pp. 80, 83.

Kuchkar ♂, *Mesh* ♀, Wakhan; *Kulja* or *Gulja* ♂, *Arkar* ♀, Turki (E. Turkestan).

Closely allied to *O. hodgsoni*, from which this great sheep is distinguished chiefly by the form of the horns, partly by colour. It has a white ruff on the throat and dark crest on the nape. The horns in adult males are enormous, less in girth than in *O. hodgsoni*, but much longer, each forming a spiral of considerably more than a circle. Horns in the female compressed, very similar to those of *O. hodgsoni*.



Fig. 161.—Skull and horns of *Ovis poli*. (Guide to the Galleries of Mammalia, British Museum.)

Colour. Upper parts rather light brown or hoary brown, more or less tinged with rufescent, especially towards the border of the dark area, a darkish line of slightly lengthened hair from the nape to the withers. Lower parts, with the fore part of the neck, muzzle, chest, legs, and rump, including the tail, white; a dark mark sometimes on the tail. In summer the colour is probably darker and browner. In females the neck is brown in front.

Dimensions of an adult male with 48-inch horns:—height at shoulder 44 inches; length of head 13·25; from horns to tip of tail 62; tail with hair 5·5, without 4; length of ear in front 4·75; girth round chest 51·5 (*Stoliczka*). Basal length of a good skull 12·7, breadth across orbits 7·5. Females are not much smaller than males. Good horns of rams measure 50 to 60 inches round the curve and about 15 in girth at the base, the extreme recorded measurements being 75 and 16·75. *Servtzeff* estimates the

weight of an old male at about 600 lbs., but he did not weigh more.

Distribution. The high Pamir and the plateaus west and north of Eastern Turkestan, extending to the Alai. This sheep only comes within Indian limits in Hunza, north of Gilgit.

Habits. Precisely similar to those of *O. hodgsoni*. The rutting-season is in December and January. Some herds at this time are large.

345. *Ovis vignei*. *The Urial or Shá.*

Ovis vignei, *Blyth*, *P. Z. S.* 1840, p. 70; *id.* *A. M. N. H.* vii, p. 251, pl. v, fig. 9 (1841); *Hutton*, *J. A. S. B.* xv, p. 152; *Horsfield*, *Cat.* p. 175; *Sclater*, *P. Z. S.* 1860, p. 127, pl. lxxix; *Scully*, *P. Z. S.* 1881, p. 209; *W. Sclater*, *Cat.* p. 139.

- *Ovis cycloceros*, *Hutton*, *Calc. Jour. N. H.* ii, p. 514, pl. xix (1842); *Sclater*, *P. Z. S.* 1860, p. 128, pl. lxxx; *Blyth*, *Cat.* p. 177; *Jerdon*, *Mam.* p. 294; *Blanford*, *Eastern Persia*, ii, p. 87; *Thomas*, *Tr. L. S.* (2) *Zool.* v, p. 63; *W. Sclater*, *Cat.* p. 138.

Ovis montana, *Cunningham*, *Ladak*, p. 190, pl. vii (1854), *nec* G. Cuvier.

Caprovis vignei, *Adams*, *P. Z. S.* 1858, p. 526.

Ovis blanfordi, *Hume*, *J. A. S. B.* xlvi, pt. 2, p. 327, pl. iv. (1877).

Guch ♂, *Mish* ♀, *P.*; *Shá* (*Shápo* ♂, *Shámo* ♀), *Ladak*; *Urin*, *Astor*; *Koh-i-dumbá*, *Afghanistan*; *Koch*, *Gad* ♂, *Garand* ♀, *Baluch* and *Sindhi*; *Kur* ♂, *Gad* ♀, *Brahui*; *Uriúl*, *Punjab*.

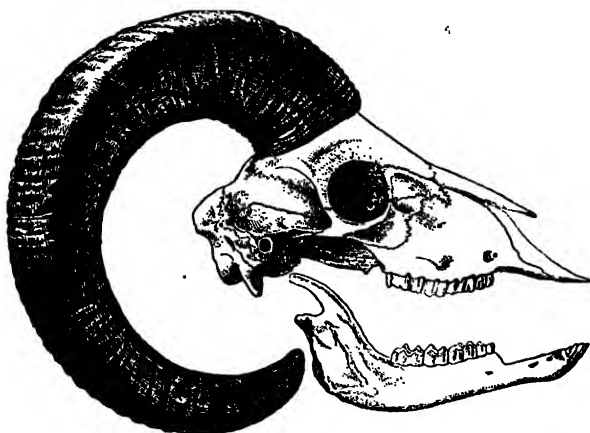


Fig. 162.—Skull and horns of *Ovis vignei* (Salt Range variety).

Fur coarse, close and short. Tail short. Adult rams have a gular ruff of long hair commencing behind the chin in two lobes, which immediately unite and extend down the middle of the throat to the chest.

Horns in male coarsely wrinkled transversely, triangular in section; orbital and nuchal surfaces not very much broader than

frontal; fronto-orbital edge sometimes much rounded, the others, as a rule, less so. The two horns arise close together, diverge considerably, and are curved round nearly in a circle, sometimes keeping almost, or even absolutely, in one plane, sometimes wound spirally. The curve very rarely exceeds a circle. Horns of females are short and nearly straight.

Colour above in summer rufous grey or fawn, in winter light greyish brown; lower parts, limbs, buttock, and tail whitish or white; ruff sometimes black throughout, but generally with some white hairs and in old rams white in front, gradually passing into black behind. Muzzle in old animals whitish or white. A patch behind the shoulder black or blackish, sometimes a blackish lateral line and markings outside the limbs. Females and young males are almost uniform greyish brown, paler beneath.

Dimensions. Height of a male 32 inches, length 48, tail 4. Some Ladak specimens are larger and are said to be 3 feet or more in height. A male Ladak skull measures 9.25 in basal length, and 5.5 in breadth across the orbits. A Punjab skull is about half an inch less in length. Horns measure 24 to 30 inches round the curve, and about 10 in girth at the base, the maximum recorded length and girth being 37.75 and 11.5.

Distribution very wide. The shá is found in Ladak and Zaskar, and, according to information obtained by Mr. Hume from Mr. Dalgleish, considerably farther east in Northern Tibet, at elevations of 12,000 to 14,000 feet, and it ranges through Astor and Gilgit, where it is known as úrin, to Afghanistan. The Astor animal is the typical *O. vignei*. The uríal, which I now regard as identical, is found in the Punjab Salt Range and in places throughout the ranges west of the Indus in the Punjab and Sind down to the sea-level. To the westward this animal is found throughout Afghanistan, Baluchistan, and Southern Persia.

Varieties. Until recently I believed, as Selater, Blyth, Jerdon, and others did, that the Ladak shá, *O. vignei*, was distinct from the Punjab, Sind, and Baluchistan uríal, usually known as *O. cycloceros*. But an examination of the series of skulls collected by Mr. Hume shows the impossibility of distinguishing the two by the horns. The shá is undoubtedly, on an average, larger, the circle made by the horns is wider, the horns are thicker at the base, and their edges, especially the fronto-orbital, are more rounded as a rule; the ruff, too, is said to be much less developed. According to some MS. notes for which I am indebted to Mr. Hume, horns of uríal scarcely ever exceed 10 inches in girth at the base, whilst shá horns are sometimes between 11 and 12 in circumference. Judged by this test, as Mr. Hume has pointed out to me, the typical *O. cycloceros* of Hutton is identical with *O. vignei*, and the smaller uríal, if kept distinct, must bear a different name. But I cannot find any definite distinctive characters; those of colour noted by Selater I believe to be merely individual, and some skulls and horns from Ladak appear indistinguishable from Salt Range specimens.

O. blanfordi is a variety of the urial from Kelát, Baluchistan, with horns diverging throughout so as to form an open spiral, instead of each lying in one plane or nearly so. Thus the tips of the horns are very much farther apart than in typical *O. vignei*. This character, I am now convinced, is not of specific importance, and in this view Mr. Hume agrees.

Habits. In Ladak this sheep inhabits open valleys; in Astor and Gilgit it keeps to grassy ground at moderate elevations below the forest; in the Salt Range of the Punjab, and in Sind, Baluchistan, and Persia, it is found on undulating or hilly ground cut up by ravines, and is more often seen on stony and rocky hill-sides than amongst bushes and scrub. The herds vary usually from 3 or 4 to 20 or 30 in number; the sexes are generally together, but the males often keep apart in summer. These sheep are wary and active; although not such masters of the art of climbing amongst precipices as the goats, tahr, or bharal, they get over steep places with wonderful ease. Their alarm cry is a shrill whistle, their usual call a kind of bleat.

The rutting-season in the Punjab is September. According to Adams the period of gestation is 7 months, but according to Sclater (P. Z. S. 1863, p. 230), from observations in the Zoological Gardens in London, only 4. It is not improbable that the true period is between the two. The young in Astor are produced about the beginning of June, as observed by Mr. H. Littledale, and the rutting-season there must be considerably later than September. One or two young are born. This species has bred freely with tame sheep. The occurrence of wild hybrids with *O. hodgsoni* has been noted in the account of the latter. The flesh of *O. vignei* is excellent.

346. *Ovis nahura.* *The Bharal or blue Wild Sheep.*

- Ovis nayaur*, Hodgson, *As. Res.* xviii, pt. 2, p. 135 (1833).
Ovis nahoor, Hodgson, *P. Z. S.* 1834, p. 107; *id.* *J. A. S. B.* x, p. 231, pls. i, ii, p. 913, xi, p. 283; Sclater, *P. Z. S.* 1860, p. 129; *M.-Edw. Rech. Mam.* p. 357, pls. lxviii, lxix; *W. Sclater, Cat.* p. 140.
Ovis burrhel, Blyth, *P. Z. S.* 1840, p. 67; *id.* *A. M. N. H.* vii, p. 248; *id.* *J. A. S. B.* x, p. 868.
Ovis nahura, Gray, *List Mam. B. M.* p. 170 (1843); Blyth, *Cat.* p. 178; Jerdon, *Mam.* p. 296; Blandford, *J. A. S. B.* xli, pt. 2, p. 40; *id.* *Yark. Miss., Mam.* p. 85, pl. xiv.
Pseudois nahoor, Hodgson, *J. A. S. B.* xv, p. 343, xvi, p. 702; Horsfield, *Cat.* p. 176; Adams, *P. Z. S.* 1858, p. 527; Lydekker, *J. A. S. B.* xlix, pt. 2, p. 131.

Bharal, *Bharar*, *Bharut* (males often *Menda*, a ram), H.; *Na*, *Sna*, Ladak; *Wa*, *War*, Sutlej Valley; *Nervati*, Nepal; *Nao*, *Gnao*, Bhotia.

Hair of uniform length throughout, no trace of mane or ruff. No suborbital glands nor lachrymal fossæ, but interdigital and inguinal glands present. Ears short. Tail longer than in *O. vignei* and *O. hodgsoni*.

Horns in males rounded at the base or subquadrangular, nearly

smooth, with transverse striæ, arising close together, curving outwards, first upwards, then downwards, and lastly backwards. In females the horns are short, slightly curved upwards and outwards, suboval in section, the longer diameter across the head.

Colour brownish grey above, much browner in summer, slaty grey with a brownish wash in winter. Lower parts, inside and back of limbs, and buttocks as far as base of tail white. In adult males the face, chest, a stripe down the front of all limbs, but broken by white at the knees in the fore limbs, a band down the lower part of the side bordering the white of the belly, and the terminal two-thirds of the tail black. The black markings on the face, chest, and sides are wanting in females.



Fig. 163.—*Ovis nahura*.

Dimensions. Height at shoulder in males about 3 feet, length to root of tail 5, tail 7 inches; horns about 24 round curve, girth at base about 11; the greatest recorded dimensions being length 32·1 and 30·5, girth 13; basal length of skull 9·5, breadth across orbits 5·6. Females considerably smaller in all dimensions.

Distribution. Tibet from near Shigar in Baltistan, and near Sanju S.E. of Yarkand, to Moupin, and from the main Himalayan axis, or in places the high ground south of it, to the Kuenlun and Altyn Tāgh. Never found below about 10,000 feet. In summer usually seen about 14,000 to 16,000.

This animal in structure is quite as much allied to *Capra* as to *Ovis*, and is referred to the latter genus mainly because it resembles sheep rather than goats in external appearance, and hence has been gene-

rally classed with the former. Hodgson distinguished it as *Pseudois*, and there is much to be said in favour of the distinction, but the sheep and goats are so nearly allied that an intermediate generic form can scarcely be admitted.

Habits. In habits as in structure the bharal is intermediate between the sheep and the goats. Like the former it is found on undulating ground, and frequently lies down during the day on its feeding-ground, though generally amongst stones; but, like the latter, it is a splendid climber, perfectly at home on precipitous cliffs, and wont, when alarmed, to take refuge in ground inaccessible to man. It is found in herds of from 8 or 10 to 50 or even 100; the males and females being generally found apart in the summer, but frequently associating together at all seasons. The herds keep to high open ground above forest and never enter bush even. They feed and rest alternately during the day; owing to their colour it is peculiarly difficult to make them out when they are lying down amongst stones. Their flesh is excellent, especially about September, when they are in good condition.

The bharal is easily tamed if taken young, and has bred freely in the Zoological Gardens, Regent's Park. The period of gestation has not, however, been accurately determined; it is 160 days according to Hodgson. This animal has never been known to breed with tame sheep.

Genus **CAPRA**, Linn. (1766).

Syn. *Hircus*, Bodd. (1785); *Ibex*, Hodgson (1847).

Size moderate. Tail short. No suborbital nor inguinal glands. Interdigital glands wanting or confined to fore feet. No distinct muffle. A beard present in all Indian species. Mammaræ two. Callosities on the knees and sometimes on the chest. Males with a peculiar strong odour.

Skull broad at the orbits and narrowing rather suddenly in front, the occipital and frontal planes meeting at an obtuse angle, occipital and parietal area much rounded, outline of face concave. Horns in both sexes, very (30 to 54 inches) long and arising close together in adult males, much smaller and farther apart in females, commencing from the vertex and rising above the continuation of the frontal plane, scimitar-shaped or spiral, more or less compressed and angulate. Vertebrae: C. 7, D. 13, L. 6, S. 3-4, C. 9-13.

The true goats are almost confined to the Palearctic region. All live in herds, the males sometimes keeping apart from the females and occasionally being found solitary. All haunt steep cliffs and are splendid climbers, and all browse largely. They are very wary and active. The period of gestation in tame goats is about 160 days (Hodgson, J. A. S. B. xvi, pls. 1020, 1021, &c.), and is probably similar in their wild allies. •

Synopsis of Indian Species.

A. Horns scimitar-shaped.

a. Horns compressed in front. *C. ægagrus*, p. 502.

b. Horns of males flattened in front, with knobs at intervals. *C. sibirica*, p. 503.

B. Horns spirally twisted *C. falconeri*, p. 505.

Remains of a goat, closely allied to *C. falconeri*, are found in the Pliocene Siwaliks, and traces of another species in the beds of Hundes in Tibet.

347. *Capra ægagrus*. *The Persian wild Goat.*

Capra ægagrus, Gmelin, *Syst. Nat.* i, p. 193 (1788); Hutton, *Calc. Jour. N. H.* ii, p. 521, pl. xix; id. *J. A. S. B.* xv, p. 161; Blyth, *Cat.* p. 176; Blanford, *J. A. S. B.* xlv, pt. 2, p. 15; id. *Eastern Persia*, ii, p. 89; Danford, *P. Z. S.* 1875, p. 458; Sclater, *P. Z. S.* 1886, p. 315, pl. xxxi; W. Sclater, *Cat.* p. 142.

Ægoceros ægagrus, Kotschy, *Verh. zool.-bot. Ver. Wien*, iv (1854), p. 201.

Capra caucasica, Gray, *List Mam. B. M.* p. 167 (1843); Adams, *P. Z. S.* 1858, p. 525, nec *Güldenstädt*.

Capra blythi, Hume, *P. A. S. B.* 1874, p. 240.

Pásang ♂, *Boz* ♀ (generally *Boz-pásang*), P.; *Borz*, Afghan; *Sair*, *Sarah*, *Phashin*, *Pachin*, ♂ *Borz-Kuhi*, Baluch; *Chank* ♂, *Hut*, *Haraf* ♀, *Brahui*; *Ter*, *Sarah*, Sindhi; *Sind ibex* of European sportsmen.

Male with a beard on the chin only, and with the hair on the back of the neck and on the shoulders rather longer in winter. At this season a soft underfur is developed in all individuals inhabiting cold climates.

Horns of male scimitar-shaped, curved backwards, greatly compressed, the anterior edge forming a prominent keel, irregularly notched and jagged, posterior edge rounded, the outer surface of each horn more convex than the inner; the tips generally converging more or less, sometimes diverging. Horns of female much smaller, erect, curved slightly backwards, farther apart at the base than in the male, slightly compressed, oval in section and ribbed.

Colour brownish grey in winter, yellowish or rufous-brown in summer, lower parts and inner portion of buttocks whitish or white. Older males are paler and have the face, back of the neck, shoulders, a stripe along the back, the tail, chin, and throat, with the beard, the front of all legs, except at the knees, and a stripe along the lower part of each side joining the band of the hind leg dark brown. The carpus and tarsus are all white except the dark band in front. These markings vary much in distinctness.

Dimensions. A full-grown male was 37 inches high at the shoulder, muzzle to end of tail 61·5, tail with hair 5 (*Hutton*). Females are less, and both sexes in Lower Sind are usually small. Basal length of a male skull 9·2, orbital breadth 4·8. Good horns measure 40 inches round the curve, the extreme length known being 52·5, with a basal girth of 7, in a specimen killed by General Marston in the Karáchi hill-tracts.

Distribution. The hills and mountains of South-western Asia, from the Caucasus to Sind. Formerly common in the Grecian Archipelago. Within Indian limits, this wild goat is found on the barren hills of Baluchistan and Western Sind, but not east or north-east of the Bolan Pass and Quetta, as it is replaced by *C. falconeri*. Specimens of a wild hybrid between the two were obtained by the late Sir O. B. St. John on Takatu near Quetta. This goat, which does not occur east of the Indus, is found near the sea-level in Sind and Baluchistan, but ascends to 12,000 or 13,000 feet in Persia.

Habits. The wild goat of Sind and Baluchistan inhabits barren rocky hills in herds of varying numbers, keeping much to cliffs and crags. It is very active, and leaps with wonderful precision from one ledge to another on the face of a precipice, having like other goats, as Hutton has pointed out, a peculiar power of stopping short and balancing itself on a very small foothold after a leap up or down. Hutton also states that he has seen a male of this goat, kept tame, save itself when it has made a false step by falling on its horns.

One or two kids, sometimes, it is said, three, are produced at a time, about May in the Caucasus, but I believe earlier in Sind, for I saw a very young animal captured in the Khirthar range on March 11th.

The true bezoar, formerly famous in Europe and still regarded in Persia as an antidote to poison, and as a remedy in many diseases, is a concretion found in the stomach of this goat, which was known to the older European writers as *Pazen* or *Pasen*, evidently a corruption of the Persian name. The *Capra bezoartica* of Linnæus was doubtless intended for this species, although the description cannot be recognized. The subject is fully discussed by Danford.

There can be no doubt that *C. agagrus* is one of the species, and probably the principal, from which tame goats are derived.

• 348. *Capra sibirica.* *The Himalayan Ibex.*

Capra sibirica, Meyer, *Zool. Annal.* i, p. 397 (1794); *Blyth, Cat.* p. 176; *Jerdon, Mam.* p. 292; *Blanford, Yark. Miss., Mam.* p. 86; *Scully, P. Z. S.* 1881, p. 208; *Aitchison, Tr. L. S.* (2), *Zool.* v, p. 64; *W. Sclater, Cat.* p. 143.

Himalayan ibex, *Blyth, P. Z. S.* 1840, p. 80.

Capra ibex, *Hodgson, J. A. S. B.* x, p. 913, xi, p. 283, *nec Linn.*

Capra sakeen, *Blyth, J. A. S. B.* xi, p. 283 (1842).

Ægoceros skyn, *Wagner, Schreb. Säugeth. Supp.* iv, p. 491 (1844).

Capra himalayana, *Schinz, Syn. Mam.* ii, p. 463 (1846); *Adams, P. Z. S.* 1858, p. 523.

Ibex sakin and sibirica, *Hodgson, J. A. S. B.* xvi, p. 700.

Skin or Sakin ♂, *Dabmo* or *Danmo* ♀, Ladak; *Kail*, Kashmir; *Tangrol*, Kulu; *Buz*, Kunawár; *Skiu*, Balti.

Build rather heavy, legs short. Male with a profuse beard confined to the chin, and with a ridge of coarse dark hair along the back. Hair coarse and brittle, with, in winter, dense soft woolly underfur (pashm or tús).

Horns scimitar-shaped, curved backwards, diverging, the points sometimes converging slightly; nearly triangular in section, the anterior surface flat, with large knobs at tolerably regular intervals, hinder edge compressed. In the female the horns are much smaller, set wider apart, rugose, almost riuged, oval in section at the base, compressed above, curving slightly backwards.

Colour in summer brown, scarcely paler beneath, old males being chocolate, with patches of dirty white on the back. In winter the general colour is yellowish white, tinged with brown or greyish. There is generally a dark band on the back. Legs dark. Beard and tail dark brown.

Dimensions. Height of males at shoulder about 40 inches; females one-third smaller (*Kinloch*). Basal length of a male skull 10·8; orbital breadth 6. Good horns of males measure 40 to 45 inches round the curve; the greatest recorded length is 54 with a girth of 11·5 inches above the lowest knob. Female horns measure about a foot in length.

Varieties. A very dark-coloured ibex is said to occur in Baltistan, but is, according to Scully, merely the old male in winter vesture. Ibex from Siberia and from the Thian Shan Mountains north of Káshgarh have the abdomen and the back of the carpus and tarsus white, contrasting strongly with the front of the legs, which is very dark brown. Colonel Biddulph, to whom I am indebted for calling my attention to this character, is of opinion that the Thian Shan animal is true *C. sibirica* and the Himalayan one distinct, in which case the latter would take the name of *C. sukin*. I have only been able to examine one undoubted Himalayan skin, and cannot say if the difference is constant.

Mr. R. A. Sterndale has described and figured (*Jour. Bombay N. H. Soc.* i, p. 24) the head of an ibex purchased in Kashmir. The horns are 52 inches long, dark coloured, and remarkably curved round, much more than in ordinary *C. sibirica*; there are no knobs except near the tips. In section the horns resemble those of *C. sibirica*. Three specimens are recorded, and it is suggested they may come from the country west of Kashmir. Mr. Sterndale proposed to call this wild goat *C. dauvergnei* if new.

Distribution. The mountain ranges of Central Asia from the Altai to the Himalayas, and from the neighbourhood of Herat to Kumaun. The ibex occurs in most of the high ranges north of Kashmir, but not in the Pir Panjál, and it also inhabits the higher Himalayas as far east at all events as the source of the Ganges. It is not known to occur farther east in the Himalayas nor in Eastern Tibet, and although it is included in Hodgson's lists of Nepal mammals, there are no specimens in his collection; but when in Northern Sikhim, I heard from Tibetans of an animal, probably this species, inhabiting the mountains north of Shigatze, and Hodgson obtained similar information as to its occurrence north of Lhasa and Digarchi.

Habits. The ibex of the Himalayas is found on and about precipitous cliffs at high elevations close to the snow at all seasons.

Its habits have been well described by Adams, Kinloch, and others. Owing to the protection afforded by its thick underfur, it is but little affected by cold, and "even during the winter ibex do not as a rule descend very low, but resort to places where, from the steepness of the hill-side, snow does not lie in any quantity. At this season males and females herd together, but as the snow melts and the time (May and June) for the birth of the young approaches, the old males forsake the females altogether, and, as the summer advances, retire to the most inaccessible mountains, frequently sleeping during the day above the limits of vegetation, and descending great distances to feed in the morning and evenings." (*Kinloch*). The males descend about October and mix with the herds, the rutting-season being in winter.

Kinloch also says:—"Although an excessively wary animal, the ibex is usually found on such broken ground that it is not very difficult to obtain a shot. The grand rule, as in all other hill-stalking, is to keep well above the herd, whose vigilance is chiefly directed beneath them. In places where they have been much disturbed, one or two of the herd usually keep a sharp look out while the others are feeding, and on the slightest suspicion of danger the sentries utter a loud whistle, which is a signal for a general rush to the nearest rocks."

The female has one or two young. Many of these animals are killed for the sake of obtaining the soft woolly underfur, which is woven into cloth, and used for lining articles of dress.

• 349. *Capra falconeri*. *The Markhor*.

Ægoceros (*Capra*) *falconeri*, *Hügel, Wagner, Münch. gel. Anz.* ix, p. 430 (1839).

Capra megaceros, *Hutton, Calc. Jour. N. H.* ii, p. 535, pl. xx (1842); *id. J. A. S. B.* xv, p. 161; *Blyth, Cat.* p. 176; *Jerdon, Mam.* p. 291.

Capra falconeri, *Hügel, Kaschmir*, iv, p. 579, pl.; *Blanford, J. A. S. B.* xlv. pt. 2, p. 17; *Scully, P. Z. S.* 1881, p. 209; *Sclater, P. Z. S.* 1886, p. 317; *W. Slater, Cat.* p. 145.

Hircus megaceros, *Adams, P. Z. S.* 1858, p. 525.

Capra jerdoni, *Hume, P. A. S. B.* 1874, p. 240.

Márkhor (snake-eater), Afghanistan, Punjab, and S. Kashmir; *Ráche* (*Rápho-che* ♂, *Ráwa-che* ♀), Ladak; *Rezkuh*, *Mutt*, ♂, *Hü*, *Haraf* ♀, Brahui; *Pachin*, *Sará*, ♂, *Buzkuhi* ♀, Baluch.

Beard in old males long and copious, extending from the chin down to the breast; in females and young males short, confined to the chin. Little or no underfur. Horns of males compressed, close together at the base, spirally wound, sharply angulate in young animals both in front and behind, more rounded in front at the base in old animals; the anterior keel turns outwards at first in each horn. In some the horns form an open spiral like that of a corkscrew, in others each horn is straight and conical, with the two keels winding round it, like the worm of a screw. Horns of females short, compressed, spiral.

Colour in summer rich reddish brown, in winter grey; hair of the body long, white at the base with brown tips, lower parts paler, sometimes whitish; carpus and tarsus with a dark stripe in front, tail dark brown. The young are greyish brown throughout, with a darker stripe down the back. Beard black in front, light grey behind, said in the young to be black throughout. Old males in summer look whitish throughout.

Dimensions. An old Gilgit male measured by Colonel Biddulph was 38.5 inches high, and 55 from between the horns to the root of the tail. Much longer dimensions are given by other writers. A skull measures 10 inches in basal length, 11.25 in extreme length, and 7.5 in orbital breadth. The length of the horns varies in different varieties.



Fig. 164.—Head of *C. falconeri*, Astor var. (Copied from the figure of the type in Hügel's 'Kaschmir'.)



Fig. 165.—Head of *C. falconeri*, Pir Panjál var. (Copied from Kinloch's 'Large Game Shooting'.)

Distribution. The Pir Panjál ranges south of Kashmir (not east of the Chenab) and the ranges of Baltistan, Astor, and Gilgit to the north. Hazára, and many of the hill ranges of Afghanistan, amongst others the Sulemán range as far south as Gendári Hill near Mithankot, also Takatu and Chehiltan near Quetta.

Varieties. Throughout the *Bovidæ* no species varies to so great an extent in the form of the horns as the markhor, and those who have seen but two or three varieties naturally regard them as belonging to distinct species. Four varieties are worthy of notice:—

1. The true *Capra falconeri* of Astor and Baltistan. (Fig. 164.)

This has massive horns forming a very open spiral, never exceeding $1\frac{1}{2}$ turns.

2. The Pir Panjal markhor. (Fig. 165.) The spiral is less open. The horns have from 1 to 2 turns of the spiral in fine heads. This race extends, I believe, to Hazara and Gilgit, but it passes into the last and the next by every possible gradation. A horn of this or the first variety is said to have measured 63 inches round the curve (starting at back of horn) and 14.75 in girth at the base. Good horns measure 36 inches straight from base to tip, and 45 to 50 round the curve.

3. True *C. megaceros* of Hutton, from near Cabul. (Fig. 166.) Horns almost straight, but still having a slight spiral. Hutton had a horn of this that measured 42 inches straight from base to tip and 44 round the (? front) curve; horns of 60 inches are said to occur.

4. The Sulemán race, for which the name of *C. jerdoni* was proposed by Mr. Hume. (Fig. 167.) Many, perhaps most horns of this

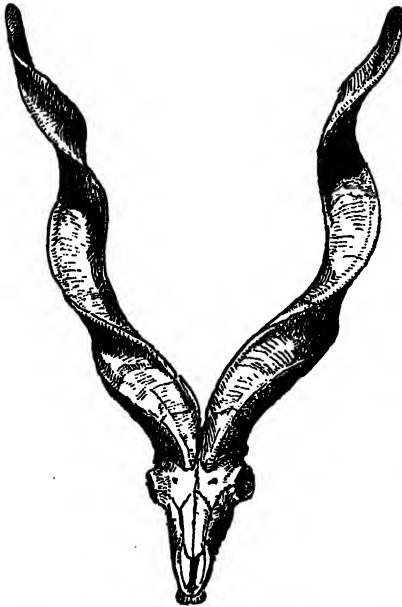


Fig. 166.—Head of *Capra falconeri*, Cabul var. (Copied from Hutton's figure of *C. megaceros*.)



Fig. 167.—Head of *Capra falconeri*, Sulemán var. (*C. jerdoni*, Hume). (Copied from Kinloch's 'Large Game Shooting'.)

race are absolutely straight and conical, with the two keels, anterior and posterior, wound spirally round, the curve of the spiral much sharper than in other varieties, so that in good horns there are two or three complete turns. Other heads, however, show a complete passage into the Cabul form. The longest recorded horns of the

Sulemán markhor were 36 inches in length straight and 49 round the curve (beginning behind), girth at base 10·5; the main ridge made $3\frac{1}{2}$ turns. This race is said to be considerably smaller than that of the Pir Panjál and to have a less developed beard. In the extreme south, however, near Quetta, the horns again assume an open spiral.

The accompanying figures (pp. 506, 507) show the variation in the horns, but it must not be forgotten that intermediate varieties occur. It is true that heads from one locality are, as a rule, similar to each other, but when a series from various places is examined it appears to me impossible to draw a line between the different types.

Habits. These vary with the character of the ground. Kinloch says:—"Unlike ibex, which keeps to the rugged crags and steep ravines above the limit of the forest, the markhor delights in rocky forests, and although it occasionally comes out into the open glades, it seeks concealment as much as possible." Like other goats it generally occurs in herds, and keeps much to steep rocky cliffs. In Afghanistan, where forest is, as a rule, wanting, the markhor is found in stony ravines and on steep hill-sides, and is found in some places at a low elevation. Wherever it inhabits high ranges it is usually driven to the valleys when heavy snow falls, and Col. Biddulph, who has noticed that the sensitiveness to cold shown by this goat is due to its wanting the woolly underfur or pashm, so greatly developed in *Capra sibirica*, tells me that he once found and captured an adult male markhor, driven down by snow, in his garden at Gilgit.

The markhor is in appearance by far the grandest of all wild goats, and although it attains a considerable weight, no species excels it in agility and skill in climbing difficult and dangerous ground. Hutton, who had both this species and *C. aegagrus* in captivity, gave the palm to the markhor for agility, and Mr. H. Littledale, after hunting markhor, remarked on the heavier build of the ibex which he met with in Astor.

The young, one or two in number, are produced about May and June in Astor and Gilgit. Markhor have repeatedly bred in confinement with domestic goats, and it was at one time supposed that the tame races with spiral horns were derived from *C. falconeri*. It is not improbable that some are thus descended. But the spiral in tame goats is almost always in the reverse direction to that found in markhor, the anterior ridge in the tame animals turning inwards at first in each horn. I have, however, seen exceptions; there is one from Nepal in the British Museum.

Genus **HEMITRAGUS**, Hodgson (1841).

A small muffle. Mammæ 4 or 2. No suborbital, inguinal, nor interdigital glands. No beard. Males odorous.

Skull long and narrow, orbits scarcely projecting. Occipital plane flat, meeting the frontal at a right angle or rather less. Horns close together at the base, small (rarely exceeding 15 or 16 inches), not very much larger in males than in females, commencing

in the same plane as the forehead and curving backward, compressed, angulate in front. Otherwise as in *Capra*.

This genus is by many naturalists united to *Capra*, but appears fairly separable, the skull and horns differing greatly. The only two known species are Indian. Their habits are precisely those of goats.

Synopsis of Indian Species.

Horns flattened externally. Mammæ 4..... *H. jemlaicus*, p. 509.
Horns convex externally. Mammæ 2..... *H. hyllocrius*, p. 511.

A fossil species, *H. sivalensis*, has been found in the Pliocene of the Siwaliks.



Fig. 168.—*Hemitragus jemlaicus*.

Hemitragus
jembahicus

350. *Hemitragus jemlaicus*. *Thé Tehr or Tahr*.

Capra jemlahica, *Ham. Smith, Griffith's An. King.* iv, p. 308, pl. (1827); *Sclater, P. Z. S.* 1886, p. 317; *W. Sclater, Cat.* p. 146.

Capra jharal, Hodgson, As. Res. xviii, pt. 2, p. 129, pl. (1833); *id. P. Z. S.* 1834, p. 106; *id. J. A. S. B.* iv, p. 491.

Capra quadrimammis, Hodgson, J. A. S. B. iv, p. 710; v, p. 254.

Hemitragus quadrimammis vel jharal, Hodgson, J. A. S. B. x, p. 913.

Hemitragus jemlaicus, Adams, P. Z. S. 1858, p. 523; *Blyth, Cat.* p. 175; *Jerdon, Mam.* p. 286; *Blanford, J. A. S. B.* xli, pt. 2, p. 40; *Lydekker, J. A. S. B.* xlii, p. 286.

Tehr, Jehr, Western Himalayas; *Kyts, Jagla*, Kashmiri; *Jhula* ♂, *Tahrni* ♀, Kunáwar; *Esbu*, Sutlej above Chini; *Kart*, Kulu, Chamba, &c.; *Jhardi*, Nepal.

Hair on head short, on body longer, and on the neck, shoulders,

and breast so long in old males as to form a shaggy mane reaching to below the knees. Tail short, depressed, nude below; knees and breast callous. Four mammæ.

Head long, face narrow and straight; nasals narrow. Horns almost touching or touching at the base, slightly wrinkled transversely, greatly compressed, flattened on each side, more rounded but still slightly flattened towards the base behind, strongly compressed and furnished with a distinct nodose keel in front, diverging from the base, curved sharply backwards, converging again a little at the tips.

Colour rich dark brown or reddish brown, old males much darker; the fur pale at the base, dark brown towards the ends. There is considerable variation in colour, some individuals of both sexes being very pale. The face and the front of all the limbs very dark, almost black in some; a dark band, indistinct in old males, down the back. The backs of the limbs pale or rusty red in males. Young animals are greyish brown; kids are said to be very pale.

Dimensions. Height of a male at shoulder 36 to 40 inches, nose to root of tail 4 ft. 8 in., tail without hair 3·25, with hair 7. Extreme length of skull 10·75; orbital breadth 5·4. Horns 12 to 15 inches long outside the curve; extreme measurement recorded 16·5, with a basal girth of 11·5. Females are much smaller, and the horns seldom exceed 10 inches in length.

Distribution. Throughout the Himalayas from the Pir Panjal to Sikkim (I have skins from the latter, obtained by Mr. Mandelli), in the higher forests.

Habits. Col. Kinnloch's account is excellent. He says:—"The tahr is, like the markhor, a forest-loving animal, and although it sometimes resorts to the rocky summits of the hills, it generally prefers the steep slopes which are more or less clothed with trees. Female tahr may be frequently found on open ground; but old males hide a great deal in the thickest jungle. Nearly perpendicular hills with dangerous precipices, where the forest consists of oak and ringal cane, are the favourite haunts of the old tahr, who climb with ease over ground where one would hardly imagine that any animal would find a footing." He adds that tahr and markhor are found together on the Pir Panjal.

Like the true goats, tahr associate in herds, the males and females at times keeping apart. They rut in winter, and the females produce one kid as a rule in June or July, the period of gestation, according to Hodgson, being six months. But it is necessary to point out that Hodgson's information about this animal's habits was chiefly derived from his collectors and was not always correct. He, however, kept some individuals tame with a flock of tame goats, but, although they had free intercourse, no offspring was produced. He also states that in Nepal a hybrid was born between a male tahr and a female spotted deer, but the story must, I think, be erroneous.

The flesh of the female tahr is excellent, but that of old males is too rank for European tastes, though much relished by particular classes of natives.

351. *Hemitragus hylocrius*. *The Nilgiri wild Goat*.

Kemas hylocrius, *Ogilby*, *P. Z. S.* 1837, p. 81.

Capra (Ibex) warryato, *Gray*, *A. M. N. H.* x, p. 267 (1842).

Hemitragus hylocrius, *Blyth*, *J. A. S. B.* xxviii, p. 291; *id. Cat.* p. 175; *Jerdon*, *Mam.* p. 288.

Capra hylocrius, *Sclater*, *P. Z. S.* 1886, p. 318; *W. Sclater*, *Cat.* p. 146.

Warri-ádú, *Warri-átú*, Tam.; *Kard-ardu*, Can.; *Mulla-átú*, Mal.; *Ibex* of European sportsmen.

Hair short, thick, and coarse. A short stiff mane in males on the ridge of the neck and withers. Knees callous. The face slightly concave at the end of the frontals, nasals a little convex in front. Horns almost touching at the base and subparallel for some distance, then curved back and diverging slowly; they are transversely wrinkled, flat inside, convex outside, rounded behind, with a low compressed keel inside at the front. Mannlæ two.

Colour dark yellowish brown, with a greyish tinge in females and young; a dark band down the back; lower parts paler. Old males are dark sepia-brown, almost black on the face and limbs; a broad band on each side of the face, and an area behind the eye grizzled and paler, fawn-coloured around the eye; a large area in the lumbar region and the legs grizzled white, the latter dark



Fig. 169.—Head of *H. hylocrius**.

brown in front, paler behind. The lumbar tract is almost white in very old animals, and from its being conspicuous at a distance adult males are known as "saddlebacks."

Dimensions. According to Col. Douglas Hamilton old males measure from 39 to 42 inches at the shoulder, nose to tail (straight) 50½, tail 3. Females measure up to 35 inches at the shoulder.

* I am indebted to Mr. R. A. Sterndale for making and sending to me the drawing from which this cut is taken.

Horns of males are 12 to 16 inches long round the curve; the largest recorded was 17 long and $9\frac{1}{2}$ in girth. Female horns are found 11 inches long and perhaps longer. Basal length of a male skull 0·7, extreme length 10·9, orbital breadth 4·9.

Distribution. Nilgiri and Anaimalai hills, in Southern India, and the Western Ghats from the Anaimalais to the neighbourhood of Cape Comorin, chiefly at elevations of 4000–6000 feet, but occasionally in suitable places at lower levels.

Habits. The haunts of the present species are similar to those of the tahr and of the true goats, but much more tropical. With the exception of an ibex on the higher mountains of Abyssinia, this is the only goat living south of the north temperate zone. The Nilgiri goat is found usually in herds of from 5 or 6 to 50 or 60 amongst the crags and rocky precipices that border the Nilgiris and other high ranges in the extreme south of India. It keeps above the forest and but rarely enters woods. I have more than once seen these animals feeding on the grassy hills at the top of the Kundahs west of the Nilgiris, but their usual haunts are the grassy slopes and precipitous crags on the edges of the plateau; they feed on the former in the mornings and evenings, and rest on ledges amongst the cliffs during the day. They are quite as wary and sharp-sighted as tahr or markhor, and just as nimble and alert on precipitous ground. An old doe, as with other goats, usually acts as sentinel to the herd, and they always appear to suspect danger from below and not from above. Many are killed by leopards, a few by tigers, and probably some by wild dogs.

The old male has the usual strong odour of goats, and his flesh is rank and unpalatable; that of does and young males is excellent. The breeding-season appears to extend throughout a great part of the year, kids being found with the herds, according to Col. Douglas Hamilton, in most months. The female is said to produce two young at a birth.

Genus **NEMORHÆDUS**, Ham. Smith (1827).

Syn. *Capricornis*, Ogilby (1836).

Tail short, hairy. Suborbital glands present, and opening by a small circular orifice; a large but shallow lachrymal fossa. Interdigital glands on all feet. No inguinal glands. A naked muffle. Mammæ 4.

Facial and parietal regions of skull not separated by an angle, but slightly rounded; occipital plane forming an obtuse angle with the parietal region. Orbits not projecting, the zygomatic arches wider than the orbits. Nasals more or less truncated behind, articulating with the maxillaries for a long distance. Horns in both sexes scarcely differing in size, short, conical, closely ringed, the rings small, rather irregular, and broken by longitudinal striæ. The direction of the horns is at first nearly continuous with the facial plane, then slightly curved backwards.

This genus is peculiar to South-eastern and Eastern Asia. Two species occur within Indian limits. The others are *N. swinhoei* from Formosa, and *N. crispus* from Japan, both small, about the size of the goral.

Synopsis of Indian and Burmese Species.

Legs white or grey near the feet *N. bubalinus*, p. 513.
Legs rufous *N. sumatrensis*, p. 514.

See p. 514

352. *Nemorhædus bubalinus*. *The Himalayan Goat-antelope* Capricornis
or Serow. Sumatrensis

(Pocock)

Antelope bubalina, *Hodgson, P. Z. S.* 1832, p. 12; *id. Gleanings Sc.* iii, p. 122.

Antelope thar, *Hodgson, Gleanings Sc.* iii, p. 324 (1832); *id. P. Z. S.* 1833, p. 105, 1834, p. 86; *id. J. A. S. B.* iv, p. 480.

Capricornis thar, *Ogilby, P. Z. S.* 1836, p. 139.

Nemorhædus proclivus vel thar, *Hodgson, J. A. S. B.* x, p. 913 (1841).

Capricornis bubalina, *Adams, P. Z. S.* 1858, p. 522; *Blyth, Cat.* p. 174.

Nemorhædus bubalina, *Jerdon, Mam.* p. 283; *Blanford, J. A. S. B.* xli, pt. 2, p. 40; *Anderson, An. Zool. Res.* p. 335.

Nemorhædus bubalinus, *W. Selater, Cat.* p. 149.

Sardó, N.W. Himalayas; *Rámu*, *Halj*, *Sálábhír*, Kashmir; *Goa*, *Chámá*; *Aímu*, *Kunáwar*; *Yamu*, *Kulu*; *Thar*, *Nepal*; *Gya*, *Bhotia* of *Sikhim*; *Síchi*, *Lepcha*.

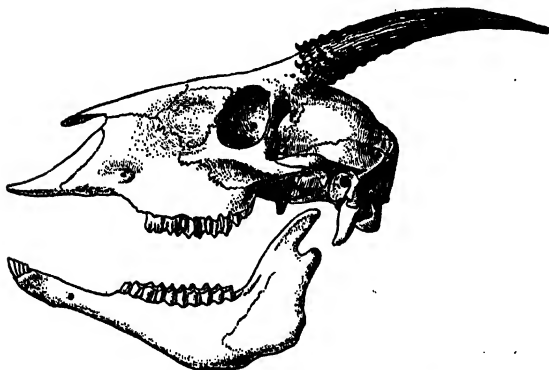


Fig. 170.—Skull and horns of *Nemorhædus bubalinus*.

Form heavy, head large. Ears large. Hair coarse, rather thin, of moderate length; a crest of rather longer hair from the nape to the withers; no underfur.

Colour black or dark grey above, somewhat grizzled owing to the hair being whitish at the base; head and neck black. The black passes into rusty red on the sides, buttocks, thighs, forearms, chest, and throat; abdomen, inside of thighs, and lower part of all

legs dirty white; inside of ears, chin in front and at the sides, also white. A black line down the back cannot always be distinguished. Horns black.

Dimensions. An adult male measured: height at shoulder 37 inches, length of head $11\frac{1}{2}$, horns to root of tail 49, tail with hair $6\frac{1}{2}$, without $3\frac{1}{4}$, total length 67, ear $7\frac{3}{4}$, girth of body 38 (*Hodgson*). Basal length of skull 10.5, zygomatic breadth 4.9; horns in male 9 to 10 long, 5 to 6 in girth, maximum recorded 13.5 and 6.5 in males, 8.75 and 4.75 in females. Weight over 200 lb.

Distribution. Throughout the Himalayas from Kashmir to the Mishmi hills at elevations between 6000 and 12,000 feet. Also obtained by Anderson in Yunnan.

Strictly, the specific name *thar* has priority over *bubalinus*, having been published earlier in 1832 (in the first notice of the "bubaline antelope" published in the 'Gleanings in Science' no Latin name was given), but as the term *thar* or *tahr* is commonly applied to *Hemitragus jemlaicus* its employment for the serow would lead to confusion. The use of native names for animals is generally to be avoided; thus the term Saráo or Sará, used in parts of the Himalayas for the present species, is applied in the Suliman range to *Capra falconeri* and in Sind to *C. agagrus*, whilst in the Sutlej valley it is used for the goral.

Habits. Kinloch says:—"The serow has an awkward gait, but in spite of this it can go over the worst ground, and it has, probably, no superior in going down steep hills. It is a solitary animal, and is nowhere numerous." It is generally found in thick forest, but often on rocky hill-sides, and "its favourite resting places are in caves, under the shelter of overhanging rocks or at the foot of shady trees. It constantly repairs to the same spot, as testified to by the large heaps of its droppings which are to be found in the localities above alluded to."

"Although very shy and difficult to find, the serow is a fierce and dangerous brute when wounded and brought to bay" . . . "When disturbed the serow utters a most singular sound, something between a snort and a screaming whistle, and I have heard them screaming loudly when they had apparently not been alarmed."

Hodgson says a single young one is born in September or October after 8 months' gestation, but Adams states that the young are born in May or June. The flesh is coarse.

353. *Nemorhædus sumatrensis.* *The Burmese Goat-antelope.*

Antelope *sumatrensis*, *Shaw, Gen. Zool.* ii, pt. 2, p. 354 (1801); *Raffles, Tr. L. S.* xiii, p. 266.

Antelope (*Nemorhædus*) *sumatrensis*, *Ham. Smith, Griffith's An. King.* iv, p. 277 (1827).

Nemorhædus sumatrensis, *Cantor, J. A. S. B.* xv, p. 272; *Beavan, P. Z. S.* 1866, p. 4; *W. Slater, Cat.* p. 150.

Capricornis sumatrensis, *Gray, P. Z. S.* 1850, p. 135; *Blyth, Cat.* p. 174; *id. Mam. Birds Burma*, p. 46; *Bock, P. Z. S.* 1879, p. 308.

Capricornis rubida, *Blyth, Cat.* p. 174.

Capricornis milne-edwardsii, David, *Nouv. Arch. Mus.* v, p. 10 (1869).
Antelope (Nemorhædus) edwardsii, M.-Edw. *Rech. Mam.* p. 364,
 pls. lxxii, lxxiii.

Nemorhædus edwardsii, Anderson, *An. Zool. Res.* p. 335.

Tau-tshiek, Burmese (*Tau-myin* in Pegu); *Kambing-ûtan*, Malay.

This appears only to differ from *N. bubalinus* in being more rufous. The present species is said to be smaller, but there is very little, if any, difference in size.

Colour varying from rufous-brown to black, the black sometimes with a white nape. A black dorsal stripe in brown examples. Legs always rufous from the thigh and forearm downwards.

Dimensions. An adult female from near Moulmein measured in height at the shoulder $34\frac{1}{2}$ inches, from nose to root of tail 49, tail without hairs 5, with hair 7; girth of body 34, ear $8\frac{3}{4}$ (*Beavan*). Basal length of a large female skull 10.5, extreme length 11.25, zygomatic breadth 4.9. Horns 8 to 9.5 long.

Distribution. From the Eastern Himalayas, Moupin, and Yunnan to Sumatra, throughout the Assam Hills, Burma, Siam, and the Malay Peninsula, on hills. An animal intermediate in colour between *N. sumatrensis* and *N. bubalinus* was killed by Col. Kinloch near Darjiling, whilst *N. bubalinus* inhabits the interior of Sikkim.

I am far from satisfied that this goat-antelope and *N. bubalinus* are really distinct, or, if they are, whether the Arakan *N. rubidus* belongs to the present form. I follow Blyth in uniting *N. rubidus* and *N. sumatrensis*, but *N. swinhoei* from Formosa, also united by Blyth, is a perfectly distinct species. The habits of *N. sumatrensis* resemble those of *N. bubalinus*, but the former inhabits less elevated ground.

A very remarkable animal, *Budorcas taxicolor*, the *Takin* of the Mishmis, is found on ranges within sight of Upper Assam, but not within our limits. It has been well described by Hodgson (*J. A. S. B.* xix, p. 65, pls. i-iii; see also M.-Edw. *Rech. Mam.* p. 367, pls. lxxiv-lxxix, and Hume, *P. Z. S.* 1887, p. 483). It is a heavily-made animal, much larger than a Serow, with stout limbs, large hoofs to the lateral digits, a short tail like a goat's, a large head, convex profile, and thick horns in both sexes, arising close together in males and curving outwards at first, then making a sharp turn and pointing backwards; whilst in females, according to Hume, the horns arise further apart and curve outwards and then backwards without any sharp twist. According to other writers, female horns resemble those of males in shape, but are smaller. Colour of the body varying from yellow dun to deep reddish-brown mixed with black; head always black. Length from snout to vent $6\frac{1}{2}$ feet, height at shoulder $3\frac{1}{2}$, tail 3 inches long; skull 18 long and $7\frac{3}{4}$ wide, horns 20 to 24 long in males, 12 in females, girth of each 9 to 10. *Budorcas* is found in herds or singly at high elevations in the Mishmi hills, and Eastern Tibet, and is probably one of the peculiar Tibetan types like *Pantholops*; it is evidently, like *Nemorhædus*, allied to both goats and antelopes; I can not see the bovine affinities attributed to it.

Genus **CEMAS**, Ogilby (1836).

Syn. *Kemas*, Ogilby; *Nemorhædus*, auct., nec H. Smith; *Urotragus*, Gray.

No suborbital glands nor lachrymal fossæ. Interdigital glands present. No inguinal glands. A naked muffle. Mammaræ 4.

The parietal and facial regions of the skull meet at an obtuse angle. Orbits somewhat more prominent than in *Nemorhædus*. Nasals very short, pointed or convex behind, separated by a fissure from the maxillaries. Horns short, of nearly equal size in the two sexes, conical, curved backwards, ringed closely except at the tip, the rings rather irregular and wavy, slightly broken up by longitudinal striæ.

This genus has generally been united to *Nemorhædus*, but I think Ogilby, Hodgson, and Gray were right in separating it, the shape of the skull being very different. The species are Palearctic, and range from the Himalayas to North China. Only one is found within Indian limits; the others are *C. cinerea* and *C. grisea* from E. Tibet, and *C. caudata* from Northern China.

Nemorhedus goral 354. **Cemas goral**. *The Goral*.

Antelope goral, *Hardwicke, Tr. L. S.* xiv, p. 518, pl. xiv (1825).

Antelope (*Nemorhedus*) goral, *Hodgson, P. Z. S.* 1834, p. 85; *id. J. A. S. B.* iv, p. 488.

Kemas ghoral, *Ogilby, P. Z. S.* 1836, p. 138; *Hodgson, J. A. S. B.* xvi, p. 697.

Nemorhedus goral, *Horsfield, Cat.* p. 168; *Adams, P. Z. S.* 1858, p. 523; *Blyth, Cat.* p. 175; *Jerdon, Mam.* p. 285; *Blanford, J. A. S. B.* xli, pt. 2, p. 40; *Butler, J. A. S. B.* xliv, pt. 1, p. 332; *Lydekker, J. A. S. B.* xlvii, pt. 2, p. 286; *W. Sclater, Cat.* p. 148.

Goral, N.W. Himalaya; *Pij*, *Pijur*, *Rai*, *Rom*, Kashmir; *Sâh*, *Sâr*, *Sutlej Valley*; *Suh-ging*, *Lepcha*; *Ra-giyu*, *Sikhim Bhotia*; *Deo Châgal*, *Assam*.

Form goat-like. Limbs stout. Horns subparallel, scarcely diverging. Hair rather coarse, with a little woolly underfur; a very small crest of longer hair on the back of the neck and around the horns.

Colour brown, more or less rufous or greyish, but little paler below. Face paler and rufescent, darker near the horns. A black line down the back from the nape to the tail, which is also black, a dark line down the front of each leg, remainder of carpus and tarsus rufous brown. Throat white. Horns black.

Dimensions. Height at shoulder 27 inches, length exclusive of tail 50 (*Hodgson*); tail 4 according to *Jerdon*. Extreme length of skull 8.25, breadth across orbits 3.85. Horns of males 6 to 8 inches long, of females less; maximum length and girth recorded in males 9.75 and 4, in females 7.75 and 2.5.

Distribution. Himalayas, at moderate elevations between 3000 and 8000 feet, from Kashmir to Bhutan. Not common in the Siwálik hills according to Kinloch. According to Captain Butler this species is found in the Nága hills, south of Upper Assam.

Habits. It is difficult to improve upon Jerdon's account. He says the goral "usually associates in small parties of from four to eight or so, and frequents rugged grassy hills or rocky ground in the midst of forest. If one goral is seen, you may be pretty certain that others are not far off, and they rarely or never forsake their own grounds. If cloudy they feed at all hours, otherwise only morning and evening. When one is alarmed it gives a hissing snort, which is answered by all within hearing." The few I have seen were in pairs, but this may have been due to the time of year—September. Old males, according to Kinloch, are generally solitary.

According to Hodgson the period of gestation is six months, and the young, usually single, is born in May or June. The goral is one of the best known Himalayan animals; it cares but little for the neighbourhood of man, and is frequently found near hill-stations.

Genus **BOSELAPHUS**, Blainville (1816).

Syn. *Portax*, H. Smith (1827).

Tail long and tufted. Hind limbs shorter than fore, withers very high. Suborbital gland small; no lachrymal fossa. Interdigital glands present. No inguinal glands. Muffle large, bovine. A mane on the back of the neck in both sexes, and a tuft of hair on the throat of the male.

Frontals and parietals almost in one plane, forming a right angle with the occipital. Molars very hypsodont, a large accessory column in those of the upper jaw. Females hornless; horns in males arising a little distance apart, just behind the orbit; they are short, smooth, pointed, directed upwards and backwards, nearly straight, subconical above, triangular at the base, with the posterior side flat, and a ridge in front, which in old animals runs forwards and inwards at the base till the horns almost touch.

This is the only surviving genus in Asia of the Tragelaphine antelopes, comprising eland, kudu, &c. There is but a single living species, peculiar to India. A closely allied fossil form, *B. namadicus*, occurs in Indian Pleistocene and Pliocene beds.

*355. *Boselaphus tragocamelus*. *The Nilgai or blue bull*.

Antelope tragocamelus, Pallas, *Spic. Zool.* i, p. 9 (1767), xii, p. 13.

Antelope picta, Pallas, *Spic. Zool.* xii, p. 14 (1777); Sykes, *P. Z. S.* 1831, p. 106.

Damalis risia, H. Smith, *Griffith's An. King.* iv, p. 363 (1827); Elliot, *Mad. Jour. L. S.* x, p. 226.

Portax tragocamelus, Adams, *P. Z. S.* 1853, p. 523; *Blyth, Cat.* p. 165.

Portax picta, Horsfield, *Cat.* p. 170; *Jerdon, Mam.* p. 272.

Boselaphus tragocamelus, W. *Sclater, Cat.* p. 154.

Nil, Nilguo ♂, Nilgai ♀, *Rajh*, *Roz*, *Rojra*, H.; *Ru-i*, Dakhani, Mahr., Gujr., &c.; *Guraya*, Gond; *Murim* ♂, *Susam* ♀, Ho Kol; *Mand-poti*, Tam.; *Mairu*, *Maravi*, *Kard-kadr'ai*, Can.

General form somewhat equine; neck deep and compressed. Tail reaching hocks.

Colour of adult male dark grey, varying from bluish to brownish grey throughout, except the mane, throat tuft, terminal half of the ear outside and two spots inside, and the tip of the tail, which are black, and a patch on the throat, two spots on each cheek, the lips, chin, inside of the ears, except the two black spots, the lower surface of the tail, the abdomen, and a ring above and another below each fetlock, which are white. Females and young males brown. Horns black.

Dimensions. Male usually 52 to 56 inches (13 to 14 hands) high at the shoulder, but 58 inches is said by McMaster to have been measured; length from nose to rump $6\frac{1}{2}$ to 7 feet, tail 18 to 21 inches, ear 7. Basal length of a male skull 15.3; orbital breadth 5.85. Females considerably smaller. Horns are usually 8 to 9 inches long and 8 in girth at the base, maximum recorded measurements 11.75 and 9.5.

Distribution. The Peninsula of India from the base of the Himalayas to the south of Mysore; not in Ceylon, nor, I believe, near the Malabar coast in the Madras Presidency, although the nilgai inhabits the Konkan near Bombay. It is common in parts of the Eastern Punjab, the North-west Provinces, Guzerat and the Central Provinces, rarer to the southward. It is not found in Eastern Bengal, Assam, nor anywhere east of the Bay of Bengal, nor does it range to the Indus on the west.

Habits. Thin bush with scattered low trees or alternations of scrub and open grassy plains are the usual haunts of this animal; it is found either on level or undulating ground or on hills. It is rarely met with in thick forest, though it may often be found on cultivated plains, where it does much damage to crops.

Males are often solitary, but they occasionally associate in herds, and I have seen as many as a dozen old blue bulls together. Females and young, sometimes accompanied by one or more old males, are found usually in small parties of from four to ten, though sometimes in herds of 15 to 20 or more. Nilgai feed a good deal throughout the day, and care but little for sun, though they lie down at times in shade. They both graze and browse, feeding on the leaves of ber (*Zizyphus*) and other trees, and, according to Sterndale, they devour quantities of the acrid fruits of aonla (*Phyllanthus*). He also says that they drink daily, but this does not correspond with my observations. So far as I could ascertain, in the cold season they only drink at intervals of two or three days. They keep much to the same ground, and their haunts may

be recognized by their droppings, which they are in the habit of repeatedly depositing in the same spot, until considerable accumulations are formed.

The pace of the nilgai when alarmed is a heavy gallop. It requires a good horse to catch the bull, which has, however, been not unfrequently run down and speared, but he must be pressed at first. The cow, Kinloch says, cannot be run down by a single rider, and I never heard of one being speared. Few sportsmen care about shooting nilgai, and in some places they become very tame, as they are generally protected by Hindus, who regard them as a kind of cow.

Nilgai are easily tamed, but the males are sometimes savage in confinement. Tame individuals have been taught to draw light carriages, and Sterndale relates that he trained one to carry a load and to be ridden. They have bred in confinement in Europe, and the period of gestation was found in the Regent's Park Zoological Gardens to be between 8 and 9 months (P. Z. S. 1863, p. 230). One or very often two young are produced. The flesh of the nilgai is fairly good, though inferior to that of most Indian wild *Bovidae*.

Genus **TETRACERUS**, Leach (1825).

Size small. A muffle present. An elongate suborbital gland; interdigital glands confined to the hind feet. No inguinal glands. Hoofs small, rounded in front. Tail short. Mammæ 4.

Frontal and parietal profile of skull slightly and gently rounded, the occipital meeting the parietal at a right angle. Lachrymal fossa large. Horns in the male only, usually 4 in number in adults; all the horns short, conical, smooth, the posterior pair much longer than the anterior, which are situated between the orbits, are often mere knobs and are not unfrequently wanting. Jerdon's statement that there are canines in the males is a mistake.

There is a single species peculiar to India. This is the only Indian representative of the Cephalophine antelopes of Africa or Duikerboks. Remains of *T. quadricornis* are found fossil in the Pleistocene cave-deposits of Kurnool, and a small Siwalik ruminant is referred to this genus.

356. *Tetracerus quadricornis*. *The four-horned Antelope*.

Antelope (*Cervicapra*) *quadricornis*, Blainville, *Bull. Soc. Philom.* 1816, p. 78.

Antelope *chickara*, Hardwicke, *Tr. L. S.* xiv, p. 530, pls. xv, xvi (1825); Hodgson, *J. A. S. B.* i, p. 346.

Antelope sub-4-cornutus, Elliot, *Mad. Jour. L. S.* x, p. 225, pl. iv, fig. 2 (1839).

Tetracerus chickera, Blyth, *J. A. S. B.* xi, p. 451.

Tetracerus quadricornis, Gray, *List Mam. B. M.* p. 150; Blyth, *J. A. S. B.* xvi, p. 879, xvii, p. 531; *id. Cat.* p. 165; Horsfield, *Cat.* p. 167; Adams, *P. Z. S.* 1858, p. 522; Jerdon, *Mam.* p. 274; Blanford, *J. A. S. B.* xxxvi, p. 196; W. Selater, *Cat.* p. 168.

Tetracerus chickara, quadricornis, subquadricornutus, iodes, and paccerois, *Hodgson, Calc. Jour. N. H.* viii, pp. 89, 90 (1847); *id. J. A. S. B.* xvi, p. 695.

Tetracerus subquadricornutus, *Gray, P. Z. S.* 1850, p. 117; *Sclater, P. Z. S.* 1875, p. 527.

Chousingha, *Chouka*, *Doda*, H.; *Benkra*, Mahr.; *Bhokra*, *Phokra*, Guizr.; *Bhirki*, at Saugor; *Bhir*, Gond; *Bhirul*, Bheel; *Kotari*, Chutia Nâgpur; *Kurus*, Gonds of Bastar; *Konda-gori*, Tel.; *Kondguri*, *Kaulla-kuri*, Can.; commonly in the Deccan *Jangli bakri*.

Fur thin, harsh, and short. Tail above with longer hair than on the body.

Colour dull pale brown, with a more or less rufous tinge above, passing gradually on the sides and limbs into the white of the lower parts. A dark stripe down the front of each leg, broadest on the fore limbs; muzzle and ears outside also dark. A dark stripe down the back in some specimens, probably young.

Dimensions. Height of a male at shoulder $25\frac{1}{2}$ inches, at croup 27; length from muzzle to rump 42, tail (? without hair) 5, ear $4\frac{1}{4}$. Weight 43 lb.. Females are rather smaller. Basal length of a large male skull 6.5, orbital breadth 3.2. The posterior horns are usually 3 to 4 inches long, the anterior 1 to $1\frac{1}{2}$; maximum recorded lengths 4.5 and 2.5.

Distribution. Along the base of the Himalayas from the Punjab to Nepal, and probably in most parts of the Peninsula where the country is wooded and hilly, but not in dense jungle. The four-horned antelope is not found in the Gangetic plain nor on the Malabar coast in the Madras Presidency. It is said by Mr. Murray to be found in Sind; it is common in the wooded parts of Rajputana, throughout the Bombay Presidency, the Central Provinces, and the northern parts of Madras, less abundant to the eastward in Chhattisgarh, Chutia Nagpur, Bengal, and Orissa, and to the southward in Mysore, but it occurs in the latter State occasionally, and has been observed on the Nilgiri and Palni hills. It is unknown in Ceylon and east of the Bay of Bengal. In jungle this species and hog-deer (*Cervus porcinus*) may easily be mistaken the one for the other, and some recorded localities of the latter may be due to this circumstance.

Varieties. In the Madras Presidency the anterior horns are said to be but rarely developed, and certainly fully adult animals occur without any, and with only small projections on the skull. But I can see no other difference; the skulls, whether the anterior horns are developed or not, are precisely similar in form and scarcely differ in size. In the case of a male that I obtained young in Nimar and that was kept alive by a friend in Bombay, the anterior horns did not appear till the third year, although the posterior horns were well developed early in the second. Doubtless many of the two-horned individuals seen are young. Blyth (*J. A. S. B.* xvii, p. 560) came to the conclusion that the two-horned form is merely a variety; and after reading all that has been written by McMaster and Sterndale on the subject, I agree with him.

Habits. This species differs from all other Indian antelopes in habits as much as in structure. It is not gregarious, very rarely are more than two seen together; it haunts thin forest and bush, and keeps chiefly to undulating or hilly ground. It drinks daily, and is never seen far from water. It is a shy animal, and moves with a peculiar jerky action, whether walking or running. The rutting-season is in the rains, and the young, one or two in number, are born about January or February, the period of gestation being, according to Hodgson, six months. The placentation has been described by Mr. Weldon (P. Z. S. 1884, p. 2). The present species, according to Elliot, has the habit of depositing its dung repeatedly in one spot. This does not agree with my experience.

The name *Chinkara* has been applied to this animal in error. The flesh is said to be dry, but I have often eaten it and found it better than that of most Indian deer, though not equal to antelope or gazelle. When taken young this antelope is easily tamed.

Genus **ANTILOPE**, Pallas (1767).'

Size moderate. Tail short, compressed. Large suborbital glands with a linear opening. Interdigital glands large in all feet. Inguinal glands large. No muffle, Mammæ 2. Hoofs pointed. A tuft of long hair on each knee (carpus).

Skull with prominent orbits; the frontal profile rounded off into the parietal, which meets the occipital at an obtuse angle. Supra-orbital foramina of frontals large, a small lachrymal fissure and large lachrymal fossa. Horns in the male only, arising near together, cylindrical, spiral, diverging, ringed throughout, the rings subdistant, closer together near the skull, blunt, extending all round the horns.

A single species peculiar to India. The horn-cores are found fossil in the Pleistocene Jumna beds.

357. *Antelope cervicapra.* *The Indian Antelope or black Buck.*

Capra cervicapra, L. *Syst. Nat.* i, p. 96 (1766).

Antelope cervicapra, Pallas, *Spic. Zool.* i, p. 19, pls. i, ii (1767); Gray & Hardw. *Ill. Ind. Zool.* i, pls. xii, xiii; Bennett, P. Z. S. 1836, p. 34; Elliot, *Mad. Jour. L. S.* x, p. 222; Hutton, J. A. S. B. xv, p. 150; Blanford, J. A. S. B. xliv, pt. 2, p. 18; Ball, P. A. S. B. 1877, p. 171; W. Sclater, *Cat.* p. 162.

Antelope bezoartica, Gray, P. Z. S. 1850, p. 117; Blyth, *Cat.* p. 171; Jordon, *Mam.* p. 275; Blanford, J. A. S. B. xxxvi, pt. 2, p. 196; Stoliczka, J. A. S. B. xli, pt. 2, p. 229.

Ena ♂, *Harina*, *Mirga*, Sanscr.; *Haran*, *Harna* ♂, *Harni* ♀, *Kakvit* ♀, *Mrig*, H.; *Kala* ♂, *Goria* ♀, Tirhoot; *Kalsar* ♂, *Baoti* ♀, Behar; *Bureta*, Bhagalpur; *Bārānt*, Sāsin, Nepal; *Alaki* ♂, *Gandoli* ♀, Baori; *Bādū*, Ho Kol; *Bāmāni-haran*, Uria and Mahr.; *Phandayat*, Mahr.; *Kutsar*, Korku; *Veli-man*, Tam.; *Irrī* ♂, *Ledi*, *Jinka*, Tel.; *Chigri*, *Hūlt-kara*, Can.

The horns vary in divergence and in closeness of spiral; in some

the points are not more than 7 inches apart, in others as much as 20, irrespective of length; the turns of the spiral in adults vary from less than 3 to 5. Horned females are occasionally, but very rarely, met with; I once saw one, near Nágpur. In these the horns curve back, more or less, from the head.

Colour of does and young bucks yellowish-fawn above and on the outside of the limbs, lower parts white, the two colours sharply divided; a distinct pale lateral band a little above the line of division. Old bucks are blackish brown above, becoming almost black in very old animals, except on the nape, which remains brownish rufous, whilst the sides and front of the neck, and also the face except a white area round each eye, are blackish brown. The pale lateral band disappears in old males.

Dimensions. Height at shoulder, about 32 inches; length of head and body 4 feet, tail 7 inches, weight about 90 lb. Basal length of a male skull 8·6; breadth across orbits 4·1. Horns of adults are usually 16 to 20 inches long, measured in front straight from base to tip; in the Peninsula they rarely exceed 22 inches. The longest horns are met with in Rajputana and Hurriana, where 28·75 inches has been recorded. Largest observed girth at base 6·25.

Distribution. India from the base of the Himalayas to the neighbourhood of Cape Comorin (the southernmost locality known to me is Point Calimere), and from the Punjab to Lower Assam, in open plains, not in Ceylon nor east of the Bay of Bengal. Not found on hills nor in thickly wooded tracts, and wanting throughout the Malabar coast south of the neighbourhood of Surat. The statement that this antelope is not found in Lower Bengal is not quite correct; none are found in the swampy Gangetic delta, but many exist on the plains near the coast in Midnapore (I have shot them near Contai), as they also do in Orissa. Antelopes are most abundant in the North-west Provinces, Rajputana, and parts of the Deccan, but are locally distributed and keep to particular tracts.

Habits. Open plains of short grass, level or undulating, and cultivated land are the usual haunts of the Indian antelope, which is generally found in herds; these are sometimes extremely numerous, and comprise occasionally several thousand animals of both sexes and all ages; but more often small herds of does, generally 10 to 30 in number, but sometimes as many as 50, are met with, attended by a single black buck, which does not always accompany the females. Very often two or three younger bucks coloured like the does remain with the latter; but these young males are sometimes driven away by older bucks, and form separate herds. This antelope never enters forest nor high grass, and is but rarely seen amongst bushes. Where not much pursued or fired at, it will often allow men to come in the open within about 150 yards, sometimes nearer. Of country-carts, bullocks, or coolies carrying loads, it often takes but little notice at half that distance.

Like most animals of open plains, the Indian antelope appears to have no particular hours for feeding, though it generally rests in the middle of the day. I cannot say it never drinks, for I have been assured by several people that it does, but I cannot help suspecting that its visits to the neighbourhood of water are for the purpose of feeding on the fresh grass to be found there. That it can exist without ever drinking is proved by its abundance between the salt Chilka Lake in Orissa and the sea, on a spit of sand 30 miles long, where the only drinking-water is from a well.

The speed and endurance of the antelope are well known. Col. W. Campbell, in 'My Indian Journal,' relates how his brother, on a fast Arab horse, once ran down and speared a buck near Dharwar, but the feat has not often been repeated. Wounded antelope are often ridden down, but sometimes require a good horse to catch them. I was once completely beaten on fair ground by a buck with a broken fore-leg, but I was on a horse that, although speedy, had but little endurance. Jerdon says: "Very rarely good greyhounds have pulled down this antelope unwounded on ordinary ground; but there are at least three localities where this coursing used to be practised successfully." The localities were on heavy sand at Pooree in Orissa and at Sirsa in the Punjab, and on fine pasture land at Point Calimere, south of Trichinopoly. Jerdon adds that on soft ground, during the rains, antelope are easily caught by good dogs. He also says: "Greyhounds are very keen after a wounded antelope, and occasionally get savage and fight over it when pulled down." This is confirmed by McMaster.

The Indian antelope, like the South-African springbok (*Gazella euchores*), has the habit of occasionally springing into the air, all the members of a herd generally bounding, one after the other. This is done, as Sir W. Elliot has shown, before they are much frightened, and when the herd is first moving off. When at speed the gallop is like that of any other animal.

Occasionally these antelopes conceal themselves in grass or cultivation, and wounded animals not unfrequently hide. Young fawns, too, are generally concealed by the mothers. The only sound I have ever heard the buck utter is a peculiar grunt that he makes when excited; the females have a hissing alarm note, according to Forsyth. Like most other Indian antelopes, they deposit their dung repeatedly on the same spot.

Like most antelopes, and indeed ruminants in general, this species is easily tamed, if captured young. Many used to be taken in nets or in snares, and one native method of capturing the bucks was to send a tame black buck with nooses attached to his horns into the herd, and to seize the wild one when entangled in the fight which inevitably ensued. The bucks are greatly given to fighting. "The rutting-season," says Mr. Elliot, "commences about February or March, but fawns are seen of all ages at every season. During the spring months the buck often separates a particular doe from the herd, and will not suffer her to join it again, cutting her off and intercepting every attempt to mingle with the rest. The two are often

found alone also, but on being followed always rejoin the herd. A buck may frequently be seen chasing one particular doe. I cannot find the period of gestation recorded.

The flesh of the Indian antelope is excellent.

Genus **PANTHOLOPS**, Hodgson (1834).

Tail short. No suborbital glands. Large interdigital glands in all feet. Inguinal glands very large. No muffle. The muzzle peculiarly swollen in the male; nostrils large and furnished inside with extensive sacs. *Mammæ 2.

Skull with very prominent orbits directed forwards; premaxillæ long, narial opening large; the frontal region gently rounded off into the parietal: occiput nearly at right angles to parietal region. No horns in females. Horns of male long, erect, arising near together, very slightly curved, sublyrate, greatly compressed laterally, ringed subdistantly in front but not behind.

Only one species exists, and this is peculiar to the Tibetan plateau, where remains of an allied form have been found fossil.

358. *Pantholops hodgsoni*. *The Tibetan Antelope*.

Antelope hodgsonii, *Abel, Phil. Mag.* lxviii, p. 234 (1826); *id. Edinb. Jour. Sci.* vii, 1827, p. 104; *Hodgson, Gleanings Sc.* ii, p. 348, pls. iii, iv; *id. P. Z. S.* 1831, p. 52; *id. J. A. S. B.* i, p. 59, pl. iv; iii, p. 134.

Antelope (Oryx) kemas, *H. Smith, Griffith's An. King.* v, p. 106 (1827).

Antelope chiru, *Lesson, Man. Mam.* p. 371 (1827).

Pantholops hodgsonii, *Hodgson, P. Z. S.* 1834, p. 80; *Adams, P. Z. S.* 1858, p. 521; *Blanford, Yurk. Miss., Mam.* p. 89, pl. xvi; *W. Selater, Cat. p.* 163.

Kemas hodgsonii, *Gray, List Mam. B. M.* 1843, p. 157; *Horsfield, Cat. p.* 166; *Blyth, Cat. p.* 173; *Blanford, J. A. S. B.* xli, pt. 2 p. 39.

Twis ♂, *Chus* ♀, *Chiru*, *Chuhu*, Tibetan.

Fur very thick and close, erect, very woolly near the skin. Hoofs pointed.

Colour very pale fawn (light rufous brown) above, the hair pinkish (or, according to Hodgson, slaty grey) towards the base, white below. The whole face and a band down the front of each leg dark brown or black in males; females have no black marks.

Dimensions. A male was 32 inches high at the shoulder, 50 in length from nose to rump, tail with hair 9, ear $5\frac{1}{2}$, girth of body 39 (*Hodgson*). The corresponding dimensions in a female were 27.5, 50 (over curves), 7.5, 8, and 35 (*Stoliczka*). A male skull is 9.8 in basal length, and 4.6 in orbital breadth. Horns are 24 to 26 inches long, exhibiting very little variation, and 5.5 to 6 in girth at the base, maximum recorded dimensions being 27.5 and 6.5.

• *Distribution.* Probably throughout the Tibetan plateau, from 12,000 to 18,000 feet elevation. Found in Northern Ladak, north of Kumaun, north of Sikkim, and also in Northern Tibet.

Habits. The Tibetan antelope is shy and wary. It is sometimes seen solitary or in small parties of three or four, sometimes in large herds, which are said at times to consist of hundreds. The sexes live apart in summer, and Kinloch, who has given a good account of this animal's habits, says he never saw a doe in Changchenmo, where bucks are not rare. This antelope keeps to the plains and open valleys, feeding morning and evening on the patches of grass, especially those on the banks of streams, and lying down during the day on the flats, in which, Kinloch says, it excavates hollows deep enough to conceal its body.

According to Hodgson, the Tibetan antelopes rut in winter; the females gestate for 6 months and produce a single young in summer.

Genus **GAZELLA**, Blainville (1816).

Syn. *Procapra*, Hodgs. (1846); *Tragops*, Hodgs. (1847); *Tragomma*, Hodgs. (1848).

Size small or moderate. Frame slender. Eyes large. Tail short. Suborbital glands small, sometimes wanting. Interdigital glands in all feet. Inguinal glands generally present. No muffle.



Fig. 171.—Skull and horns of *Gazella bennetti*.

Mammæ 2. Hoofs pointed. Generally a tuft of longer hair on each knee.

Skull resembling that of *Antilope*, but shorter in proportion: Nasals short. Lachrymal fossa variable; a distinct lachrymal fissure. Auditory bullæ large. Horns sometimes in both sexes, those of the male compressed, oval in section, erect, with a more or less marked sigmoid curve, sublyrate or lyrate, surrounded by subdistant prominent rings almost throughout.

This genus contains more than 20 species, distributed throughout Africa, Western and Central Asia (Brooke, P. Z. S. 1873, p. 535). Remains belonging to it are found in Indian Pleistocene and Pliocene deposits, those in the former agreeing with *G. bennetti*.

Synopsis of Indian Species.

- A. Females horned. Horns not turning inwards at points; no caudal disk *G. bennetti*, p. 526.
- B. Females hornless.
 - a. No caudal disk. Horns lyrate; the tips turned inwards *G. subgutturosa*, p. 528.
 - b. A white disk surrounding the tail. Horns much curved *G. picticaudata*, p. 529.

359. *Gazella bennetti*. *The Indian Gazelle.*

- Antilope bennettii*, Sykes, P. Z. S. 1831, p. 104; *Blanford*, J. A. S. B. xxxvi, pt. 2, p. 196.
- Antilope arabica*, Elliot, *Mad. Jour. L. S.* x, p. 223 (1839), *nee Licht.*
- Gazella christii*, Gray, *apud Blyth* J. A. S. B. xi, p. 452 (1842); *Hutton*, J. A. S. B. xv, p. 151.
- Gazella bennetti*, Gray, *List Mam. B. M.* 1843, p. 161; *Hutton*, J. A. S. B. xv, p. 150; *Jerdon*, *Mam.* p. 280; *Stoliczka*, J. A. S. B. xli, p. 229; *Blanford*, P. Z. S. 1873, p. 315; *Brooke*, P. Z. S. 1873, p. 544; *Ball*, P. A. S. B. 1877, p. 172; *W. Sclater*, *Cat.* p. 159.
- Antilope hazenna*, Is. Geoffr. *Jacquemont*, *Voyage*, iv, *Zool.* p. 74, *Atlas*, ii, pl. vi (1844).
- Tragops bennetti*, *Hodgson*, J. A. S. B. xvi, p. 695; *Adams*, P. Z. S. 1868, p. 522; *Blyth*, *Cat.* p. 173.
- **Gazella fuscifrons*, *Blanford*, P. Z. S. 1873, p. 317; *id.* *Eastern Persia*, ii, p. 92; *Brooke*, P. Z. S. 1873, p. 545.
- Chinkara*, *Chikara*, *Kal-punch*, H.; *Phaskela*, N.W. P.; *Ask or Ast*, *Ahu*, Baluch; *Khazm*, Brahui; *Kalsipi*, Mahr.; *Tiska*, *Buddri*, *Mudari*, Can.; *Sank-hilê*, Mysore; *Porsya* ♂, *Chari* ♀, Baori; *Burudu-jinka*, Tel.; *Ravine deer* of some Anglo-Indians.

Horns present in both sexes, those in the male nearly straight, diverging slightly from the base when viewed from the front, but having a slight S-shaped curve when seen from the side, the points curving a little forward; the number of rings is generally 15 or 16, but is said to be sometimes as many as 25; the horns in the female are much smaller, smooth and conical. Infraorbital gland distinct, having a small opening.

Colour above light chestnut, a little darker where it joins the white on the sides and buttocks; no pale lateral bands; chin, breast, lower parts, and back of thighs white, the white colour not

ascending to the root of the tail; tail nearly black, knee-brushes varying, often dark brown; a whitish streak down each side of the face; middle of face from base of horns to nostrils darker rufous, sometimes with a dusky patch above the nose; a rufous stripe outside each pale facial band.

Dimensions. An adult male measured 26 inches high at the shoulder, 28.5 at the croup, nose to rump 41.5, tail 8.5, ear 6, horns 11 (*Elliot*). Weight of bucks about 50 lb., of does 35 to 40. Basal length of a male skull 6.75, orbital breadth 3.6. Horns measured in front along the curve are usually 10 to 12 inches long, with a girth of 4 at the base; the largest recorded dimensions in males are 14 and 5, the longest known female horns measure 8 inches.

Distribution. Throughout the plains and low hills of North-western and Central India, extending throughout Baluchistan to the eastern shore of the Persian Gulf. This gazelle is found in a considerable part of the Peninsula, ranging in suitable localities throughout the Punjab, Sind, Rajputana, the N.W. Provinces, and the whole Bombay Presidency with the exception of the Western Ghats and Konkan; also Central India as far east as Palamow and Western Sarguja, and the Central Provinces as far east as Seoni and Chanda, together with the Hyderabad territories, and the Madras Presidency to a little south of the Kistna, gazelles being found at Anantapur, south of Kurnool, and in Northern Mysore.

Varieties. *G. fuscifrons* was described from a doe with distinctly, though not prominently ringed horns, 7.25 inches long, and with the dark portions of the face dark brown, obtained at Jalk in Northern Baluchistan. Sir O. B. St. John, after long search, obtained what he justly concluded must be the male, and this proved to be *G. bennetti*. The rather pale form of this gazelle from the Indian desert and Sind has been distinguished as *Gazella christii*, but is perfectly identical with the Central Indian type.

Habits. The Indian gazelle is far less gregarious than the Indian antelope, and is most commonly seen in small parties of from two to six, though I have found from ten to twenty associating in a herd. It keeps much to waste ground, especially where that is broken up by ravines, but it is seldom seen on alluvial plains, and it haunts cultivation less than the antelope. It is frequently found amongst scattered bushes or thin tree-jungle, and may be met with on undulating ground even on the top of hills; it is commonly found amongst sand-hills, and is nowhere so abundant as in parts of the Indian desert. It lives on grass and the leaves of bushes, and I believe never drinks, for it is common in tracts where there is no water except from deep wells; and although I was on the look out for some years, and saw the tracks of almost every common wild animal at the pools in stream-beds, the only water remaining in many places in the hot season, I never saw the easily recognized prints of the gazelle's hoofs. It is, however, fond of the green grass near water.

Gazelles are very swift and can but rarely be caught by dogs. The present species does not bound like the Indian antelope when disturbed. It has a peculiar habit of uttering a sharp hiss when alarmed and of stamping with its fore-foot. The doe is often seen followed by two fawns. I cannot find that the rutting-season or the period of gestation has been observed. The flesh is excellent. This species has the habit of dropping its dung repeatedly in the same spot to a greater extent than the Indian antelope, but it not unfrequently resorts to heaps of nilgai dung for the sake of depositing its own.

Gazella dorcas and several allied forms found in Northern and Eastern Africa, *G. arabica* and *G. muscatensis* from South Arabia, are nearly allied to *G. bennetti*.

360. *Gazella subgutturosa*. *The Persian Gazelle*.

Antelope subgutturosa, *Güldenstädt, Act. Acad. Petrop.* i, p. 251, pls. ix-xij (1778).

Gazella subgutturosa, *Blainv. Bull. Soc. Philom.* 1816, p. 75; *Hutton, J. A. S. B.* xv, p. 151; *Blyth, Cat.* p. 172; *Blanford, P. Z. S.* 1873, p. 313; *id. Eastern Persia*, ii, p. 91; *id. Yark. Miss., Mam.* p. 88, pl. xv; *Brooke, P. Z. S.* 1873, p. 545; *Scully, J. A. S. B.* lvi, pt. 2, p. 76; *Thomas, Tr. L. S.* (2) v, p. 64; *W. Selater, Cat.* p. 160.

Ahu, Persian.

Females hornless. Horns in males lyrate, diverging near the base and with the tips turned inwards and converging; viewed from the side the curve is S-shaped, but slight. Rings strongly marked, 16 to 25 in number. A distinct infraorbital gland and well-marked lachrymal fossa.

Colour. Upper parts rufescent sandy, lower parts and buttocks up to the base of the tail, but not including it, white; colours sharply divided on the side. A distinct dark pygal band on the edge of the white buttocks. Facial markings not very distinct, but the usual pale lateral bands down each side of the face are present, and also the median and lateral dark facial bands. Tail blackish brown.

Dimensions. Nearly identical with those of *G. bennetti*. Eastern Turkestan individuals may be rather larger. Basal length of a Persian male skull 6·75 inches, orbital breadth 3·4; of a Yarkand skull 7·5 and 3·7. The longest horns I have heard of were from Herat, and measured 14·7 inches with a basal girth of 4·5 (*Scully, l. c.*).

Distribution. Throughout the highlands of Persia, and an enormous area in Central Asia extending through Eastern Turkestan to the Gobi desert. This is the gazelle of Afghanistan and Candahar, but only occurs in British territory in Pishin, north of Quetta, as I was informed by the late Sir O. B. St. John.

Habits. Very similar to those of *G. bennetti*, except that the present species is even more of a desert animal and that it has a less tropical habitat.

A considerably larger species, *G. gutturosa*, with shorter, very pale-coloured horns, inhabits parts of Mongolia.

361. *Gazella picticaudata*. *The Tibetan Gazelle*.

Procapra picticaudata, *Hodgson, J. A. S. B.* xv, p. 334, pl. (1846), xvi, p. 696; *Blyth, J. A. S. B.* xvi, p. 725; *id. Cat.* p. 173; *Adams, P. Z. S.* 1858, p. 523; *Blanford, J. A. S. B.* xli, pt. 2, p. 39.

Gazella picticaudata, *Brooke, P. Z. S.* 1873, p. 547; *W. Sclater, Cat.* p. 161.

Goa, Râgao, Tibetan.

Females hornless. Horns in males slender, diverging, very much curved back, the tips curving forwards, but not or very little inwards; from the point the horns look nearly straight. Annulation less strongly marked but closer together than in the other Asiatic species; 25 to 30 rings in adults. No infraorbital orifice, a naked space on the face corresponding to the position of the gland; lachrymal fossa very shallow. No knee-brushes. Hair in winter long and soft, particularly long about the corners of the mouth. Tail and ears very short.

Colour above in winter light sandy fawn, grizzled by the pale tips of the hairs, greyer in summer. Lower parts white, not very sharply divided from the colour of the back; the white of the buttocks extends all round the base of the tail, forming a distinct caudal disk; tip of the tail dark rufous brown or black; no lateral or facial markings; the fawn colour of the back becomes more rufous on the border of the caudal disk.

Dimensions. Height of a fine male at shoulder 24 inches, snout to rump 43, tail 0·75, ear 5, horns along curve 13 (*Hodgson*); longest recorded horns 15·75 measured along the curve in front; greatest basal girth 4. Basal length of a male skull 6·8, orbital breadth 3·7.

Distribution. The Tibetan plateau from about 13,000 to about 18,000 feet. Found commonly in Ladak and north of Nepal and Sikhim.

Habits. Very similar to those of other gazelles. This species inhabits the bleak plains of the Tibetan plateau in small parties varying from two or three to about a dozen. They are not generally very shy, and according to Kinloch are but little frightened by noise; they are even said to pay but little attention to men passing to windward.

In the Pliocene period antelopes were represented in India by many forms now restricted to Africa. Amongst these ancient Indian antelopes were species of *Alcelaphus* (hartebeest, &c.), *Hippotragus* (sable antelope, &c.), and probably of *Cobus* (water-buck, &c.), *Cephalophus* (duikerbok), *Oreas* (eland), and *Strepsiceros* (kudu).

Although the *Giraffidæ* no longer exist in India, several extinct genera belonging to the family and one species of true giraffe have been discovered in the Indian Pliocene beds. Amongst the extinct forms *Sivatherium* is the best known; it was a large animal with two pairs of horns.

Family CERVIDÆ.

Horns, when present, taking the form of solid antlers, without core or horny sheath, and shed periodically. With but few exceptions (and those not Indian) the horns are confined to the male sex. A large lachrymal fissure in the skull. Upper canines generally present in both sexes. Molars more or less brachydont, the first molar in both jaws especially so. The lateral digits almost always present on all feet, and frequently the distal ends of the metapodials. No gall-bladder except in *Moschus*. A small muffle almost always developed. Infraorbital glands always present, and interdigital generally. Mammaræ always four, inguinal. Placentæ with few cotyledons.

The horns are composed of true bone, and during their growth are enclosed in a hairy integument supplied with blood-vessels, and known as the "velvet." When the growth is complete the integument dries and peels off. The horns are shed, as a rule, annually, and are replaced by others in the course of from three to six months. The horns increase in size year by year up to maturity, but aged stags bear small and inferior horns.



Fig. 172.—Crowns of (a) upper and (b) lower second true molars of *Cervus unicolor*, inner side uppermost.

Two subfamilies are recognized; both are Indian, and they are thus distinguished:—

Horns generally present in males. No gall-bladder .. *Cervinæ*.
 No horns. A gall-bladder..... *Moschinæ*.

The true deer are widely distributed, being found throughout the Palearctic and Oriental regions of the Old World, and in both North and South America, but they are wanting in Africa south of the Sahara, and, of course, in Australia.

The following terms are applied to the horns of deer:—Each entire horn is composed of a "beam" or main stem, and minor branches known as "tines," "antlers," or "snags." Sometimes the beam and branches are flattened or "palmated," as in the elk and fallow-deer, but generally they are rounded. The whole horn rests on a bony support or "pedicel," which is never shed, and

there is a swelling, the "burr," at the base of the deciduous portion. The tine immediately above the burr is the "brow tine" or "brow antler;" and in most Indian deer this is the only tine developed, except near the end of the horn. But in the Elaphine group of deer, to which *Cervus cashmirianus* belongs, there are two more tines springing from the beam above the brow tine, the second being known as the "bez" and the third as the "tres" (pronounced bey and trey); by many writers the tres is called the "royal." The terminal tines are known collectively as the "crown," and if they are three in number on each horn the stag is termed "royal." The inner angle between the brow tine and the beam is sometimes called the "axil."

Subfamily CERVINÆ.

No gall-bladder. Two orifices to the lachrymal canal, both on the margin of the orbit. Hemispheres of brain considerably convoluted. Cotyledons of placenta distributed over the surface.

The arrangement of Sir V. Brooke (P. Z. S. 1878, p. 889), here followed, divided the deer into *Plesiometacarpæ*, with the proximal ends of the lateral metacarpals remaining, and *Telemetacarpæ*, with the distal ends only. The two Indian genera belong to the first-named, and may readily be discriminated thus:—

| | |
|--|-----------|
| Short horns, pedicels as long as antlers or longer. No phalanges to lateral digits | CERVULUS. |
| Long horns on short pedicels. Bony phalanges of lateral digits present | CERVUS. |

Genus CERVULUS, Blainville (1816).

Syn. *Styllocerus*, H. Smith (1827); *Prox*, Ogilby (1836); *Muntjacus*, Gray (1843).

Antlers not exceeding half the length of the head, on pedicels as long as themselves or longer. A very short brow antler, the beam above undivided, but curved downward and inward at the extremity. In females there is a bristly tuft of hair and a small projection in place of each horn. A bony ridge extends from the base of the pedicel or tuft above the orbit, and down each side of the face, the two ridges converging anteriorly; there is a frontal cutaneous gland inside each ridge. Lachrymal fossa in skull very deep, and including the facial portion of the jugal; lachrymal fissure moderate. Upper canines of males very large, those of females small. Muffle large. Interdigital glands large, but confined to the hind feet. No tuft of long hair on the metatarsus. No traces of the phalanges of the lateral digits. Vertebrae: C. 7, D. 13, L. 7, S. 5, C. 13-14 (*Hodgson*).

The anatomy of *C. muntjac* has been described by Hodgson (J. A. S. B. xvii, pt. 2, p. 483).

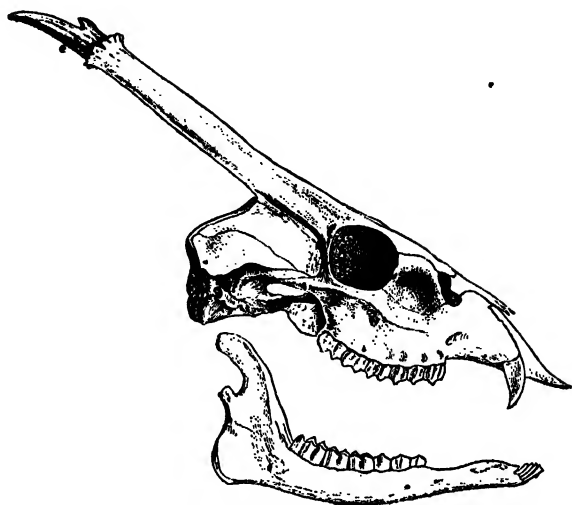


Fig. 173.—Skull and horns of *Cervulus muntjac*.

The genus *Cervulus* is found throughout the Oriental region, and is restricted to it.

Synopsis of Indian and Burmese Species.

Colour chestnut-red *C. muntjac*, p. 532.
 Colour sepia-brown *C. feræ*, p. 534.

362. *Cervulus muntjac*. *The rib-faced Deer or barking Deer.*

Cervus muntjak, Zimm. *Geog. Gesch.* ii, p. 131 (1780); Sykes, *P. Z. S.* 1831, p. 104; Elliot, *Mad. Jour. L. S.* x, p. 221.

Cervus muntjak and vaginalis, Boddaert, *Elench. Anim.* i, p. 136 (1785).

Cervulus moschatus, Blainville, *Bull. Soc. Phil.* 1816, pp. 74, 77; Horsfield, *Cat.* p. 190.

Cervus aureus, Ham. Smith, *Griffith's Cuv. An. King.* iv, p. 148 (1827).

Cervus ratwa, Hodgson, *As. Res.* xviii, pt. 2, p. 139, pl. (1833).

Cervus melas, Ogilby, *Royle's Bot. Himal.* p. lxxiii (1839).

Stylloceros muntjak, Cantor, *J. A. S. B.* xv, p. 269.

Stylloceros muntjac, Kelaart, *Prod.* p. 85 (1852).

Cervulus vaginalis, Adams, *P. Z. S.* 1858, p. 530; Blyth, *Cat.* p. 154.

Cervulus aureus, Jerdon, *Mam.* p. 264; Blyth, *Mam. Birds Burma*, p. 46.

Cervulus moschatus, curvostylis, and tamulicus, Gray, *Hand-list Edentata &c. Mam. B. M.* pp. 163, 165 (1873).

Cervulus muntjac, Brooke, *P. Z. S.* 1874, p. 38, 1878, p. 899; Anderson, *An. Zool. Res.* p. 337; W. Sclater, *Cat.* p. 173.

Kákar, H.; *Ratwa*, Nepal; *Kursiar*, Bhot; *Sikku*, Lepcha; *Maya*, Beng. Rungpore; *Gutra* ♂, *Gutri* ♀, *Bherki*, Gond; *Bekra*, *Bekar*, Mahr.; *Kánkari*, *Kárd-kari*, *Kond-kari*, *Cháli*, Can.; *Kúka-gori*, Tel.; *Kalai*, *Katu-ardu*, Tam.; *Weli*, *Hulá-muha*, Cing.; *Hugeri*, Assam; *Gyi*, Burm.; *Kidang*, Malay; *Jungli-bakri* and *Jungle-sheep*, vulgarly, in Southern India.

Colour deep chestnut, becoming darker on the back and paler and duller below. Face and limbs brownish, a black line along the inside of each horn-pedicel and for some distance inside the facial rib; this line in the female ends above in a slight tuft. Chin and upper throat, lower abdomen, lower surface of tail and inside of thighs white; a whitish mark in front of the digits on each foot. Axils whitish. A dark brown variety has been found near Darjiling by Kinloch, and a still darker form is figured in Hodgson's MS. drawings. Young spotted.

Dimensions. Height at shoulder 20 to 22 inches; length of head and body about 35; tail, with hair, 7. A male skull measures 7 inches in basal length and 2·7 in breadth across the orbits. The horns from the burr (pedicel not included) rarely exceed 5 inches in length, and are generally 2 or 3 inches, on pedicels 3 to 4 long, but horns of 11 inches are said to have been measured. Weight of a male 38 lb.

Distribution. Throughout India, Ceylon, and Burma on all thickly-wooded hills, never in the plains, nor, so far as I am aware, away from tree-forest. This deer ascends the Himalayas to about 5000 or 6000 feet, and sometimes even higher. It is rare in the Central Provinces and farther to the north-west, but I have known it killed near Baroda, and it probably occurs on the Aravalli range. Outside of India it is found throughout the Malay Peninsula, Sumatra, Java, Borneo, and eastward to Hainan, though replaced by *C. reevesi* in parts of Southern China.

Habits. The rib-faced deer is a solitary animal, usually found singly or in pairs. It keeps in thick jungle, only leaving the forest to graze on the skirts of the woods or in abandoned clearings. It has a wonderful way of getting through the thickest underwood, and it runs in a peculiar manner with its head low and its hind quarters high; when not alarmed, as Colonel Hamilton observes, it steps "daintily and warily, lifting each leg well above the grass or leaves."

The call of this species, from which the common name of "barking deer" is derived, is at a little distance very like a single bark from a dog, and is very loud for the size of the animal. It is often repeated at intervals, usually in the morning and evening, sometimes after dark, and I have heard it in Burma very late in the morning and again in the afternoon, in the cold weather, which is the rutting-season. It is uttered by the animal when alarmed, as well as when calling its mate.

Elliot and Jerdon state that the tongue is very long and extensile, and this deer often licks the whole face with it. McMaster and Sterndale confirm this. The latter has found that in confinement

this deer is a coarse feeder and fond of cooked meat. When the buck is attacked by dogs it uses its canine teeth in defence and inflicts severe wounds with them. Colonel Hamilton has pointed out that these teeth are not fixed firmly in the jaw, but that the animal has some power of moving them. Several observers have noticed a peculiar rattling noise, like that produced by a pair of castanets, made by this deer when running, but the cause is not known. Adams suggests that the sound is produced by the feet, Hamilton and McMaster think it may be made by the long canine teeth, but Kinloch says he has heard it made by a female, though he also thinks it is produced by the mouth.

The rutting-season in Northern India is chiefly in January and February, the period of gestation is six months, and the young are born, as a rule, in June and July, but some young are said to be produced throughout the year; the female has one or two young at a birth. The horns of the male fall in May and the new horns are perfect in August. These details are from Hodgson. The flesh is very good, superior to that of other Indian deer in general.

363. *Cervulus feæ*. *Fea's rib-faced Deer*.

Cervulus feæ, Thomas & Doria, *Ann. Mus. Civ. Gen.* 2, 2 a, vii, p. 92 (1889).

A short tuft of hair between the horns.

Colour above sepia-brown, speckled with golden brown, the hairs of the back having golden-yellow tips. Legs darker. Lower parts light brown. Forehead, horn-pedicels, and occiput brownish yellow, with a blackish line down the inside of each pedicel to the brown of the face. The hair around the hoofs, an indistinct line up the front of each carpus and tarsus, and a distinct band, growing broader above, up the front of each thigh, white. Tail with a narrow black band above, the rest white.

Dimensions of the type, a male:—Total length 34·6 inches; tail without hair 4, with hair 5·7; hind foot and tarsus 11·3; horn 2.

Distribution. The only specimen known was obtained on Muleyit mountain, west of Moulmein, by Mr. L. Fea.

Genus **CERVUS**, Linn. (1766).

Syn. Rusa, *Axis*, II. Smith (1827); *Rucervus*, Hodgson (1838); *Pseudocervus*, Hodgson (1841); *Procervus*, Hodgson (1847); *Panolia*, Gray (1843); *Hyelaphus*, Sundevall (1846).

Antlers large, two or three times the length of the head, on short pedicels. Upper canines never large and sometimes wanting. No bony ridge on the face. The parietal region of the skull forms an obtuse angle with the frontal plane, and a right angle with the occipital. There is a large and deep lachrymal fossa, and an extensive fissure or vacuity between the frontal, nasal, maxillary,

and lachrymal bones. The suborbital glands are large; interdigital variable. A moderate-sized muffle. A tuft of hair generally on the outer surface of the metatarsus above the middle. Phalanges of the lateral digits present.

Vertebræ: C. 7, D. 13, L. 6, S. 4, C. 11-14.

Synopsis of Indian, Ceylonese, and Burmese Species.

- A. Each horn in adults normally with more than three tines.
 - a. Brow and bez tines present; usually a pale caudal disk..... *C. cashmirianus*, p. 535.
 - b. Brow tine, no bez; no caudal disk.
 - a'. Brow tine and beam meet at a right angle. *C. duvauceli*, p. 538.
 - b'. Brow tine forming a continuous curve with beam *C. eldi*, p. 541.
- B. Each horn in adults normally with three tines.
 - a. Never spotted; large, height 48 to 56 inches. *C. unicolor*, p. 543.
 - b. Always spotted; height 30 to 38 inches .. *C. axis*, p. 548.
 - c. Spotted in summer only; height less than 30 inches..... *C. porcinus*, p. 549.

The members of this genus, like those of *Bos*, have been divided amongst several genera by many naturalists, but the differences are scarcely of generic importance, and the number of intermediate forms between the best-marked types, such as Red Deer and Sambar, renders it difficult to separate them. Of the Indian species, *C. cashmirianus* alone belongs to the Elaphine group, or true *Cervus*, which comprises the European Red Deer (*C. elaphus*) and the American Wapiti (*C. canadensis*). The other Indian species belong to the Rusing group, with a large muffle and no bez tine, and have been distributed amongst several small genera, *C. unicolor* being the type of *Rusa*, *C. duvauceli* of *Rucervus*, *C. eldi* of *Panolia*, *C. axis* of *Axis*, and *C. porcinus* of *Hyelaphus*, the last species having also been referred alternately to *Rusa* and *Axis*.

Indian fossil forms are not numerous. *C. unicolor*, *C. axis*, *C. porcinus*, and perhaps *C. duvauceli*, are represented in the Pleistocene beds of the Peninsula, and three extinct forms, one allied to *C. duvauceli*, in the Pliocene Siwaliks.

364. *Cervus cashmirianus*. *The Kashmir Stag*.

"Kashmir Stag," Blyth, *P. Z. S.* 1840, p. 79; *id.* *J. A. S. B.* x, p. 750, plate, figs. 8, 9; xxiii, p. 734.

Cervus cashmerensis, Falconer, *apud* Gray, *List Ost. Spec. B. M.* p. 65 (1847) (no description); Adams, *P. Z. S.* 1858, p. 529; Lydekker, *J. A. S. B.* xlii, pt. 2, p. 286.

Cervus wallichii, Wagner, *Hugel's Kaschmir*, iv, p. 576; Blyth, *J. A. S. B.* xxx, p. 188; *id.* *Cat.* p. 146; Jerdon, *Mam.* p. 250; *nec* Cuv. *Hist. Nat. Mam.* pl. 356 (1823).

Cervus cashmireerianus, Falconer, *Publ. Mem.* i, p. 576 (1868); Sclater, *Tr. Z. S.* vii, p. 339, pl. xxx; Brooke, *P. Z. S.* 1878, p. 912; Scully, *J. A. S. B.* lvi, p. 76; W. Sclater, *Cat.* p. 184.

Hangal, Honglu, ♂, Minyamar ♀, Kashmir; Bdrasingha, H.

Size large. In males the hair on the ridge of the neck is long, thick, and bushy, and the hair of the lower neck long and shaggy. Muffle small. Horns with brow, bez, and tres or royal tines, and usually in adults each horn with five points, sometimes with more. The tines, with rare exceptions, are undivided. The bez or second tine, as a rule, considerably exceeds the brow or first-tine in length.

Colour brown or brownish ash, or dark liver-colour; a whitish caudal disk surrounding the tail, contrasting strongly with the dark border that merges into the body-colour; sides and limbs

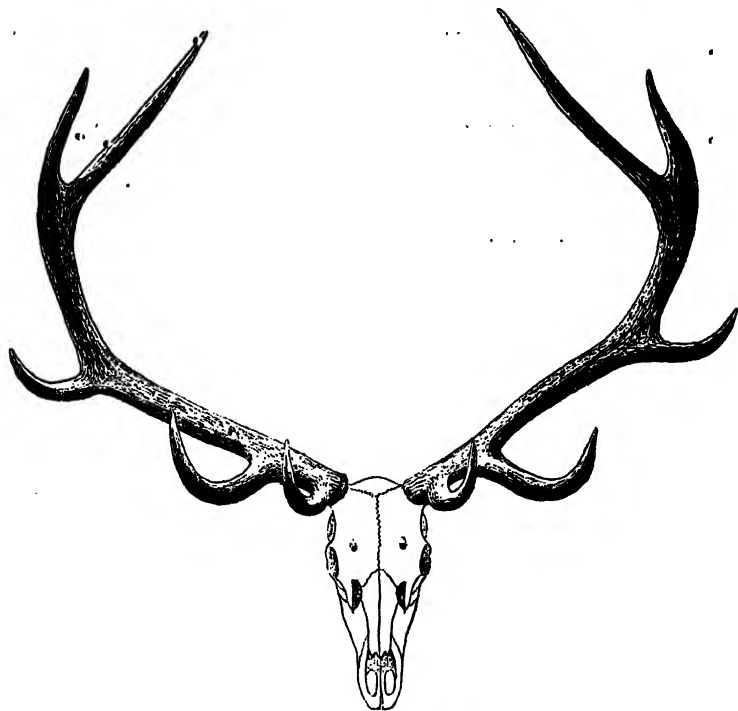


Fig. 174. --Skull and horns of *Cervus cashmirianus*.

paler; lips and chin white, ears whitish. In summer the fur is brighter and more rufous, the lower parts albescent, the belly in the male dark brown. Young fawns are spotted, the markings being retained, according to Adams, till the third or fourth year.

In Sclater's figure, from an animal in the Zoological Gardens, there is no caudal disk; the tail is dark brown above, pale below, and only the buttocks pale rufous. Whether this is due to variation in colouring or to age it is impossible to say, but a skin from the Zoological Gardens, now in the British Museum, agrees with the figure.

Dimensions. Height at shoulder 48 to 52 inches, length 7 to 7½ feet, tail 5 inches. Extreme length of a male skull 15.1 inches, breadth 7.5. Horns in adults average about 40 inches in length, and 5½ to 6 in girth at mid-beam; the longest known measure 52, 53.5, and 55 along the inside from the burr to the tip; basal girth 2.5, clear of the burr; girth at mid-beam 7.

Distribution. The Kashmir valley, throughout the pine-forests between about 9000 and 12,000 feet in summer, lower in winter. Not found east or north of Kashmir; a few occur in Wardwan, Kishtwár, Badrawár, &c.; none in Ladak. The range westward is not known; a horn referred to this species was obtained from the banks of the Oxus near Balkh by Captain Yate, but the identification is open to doubt, as there are several Asiatic stags allied to the Kashmir animal.

Habits. The Kashmir deer are found singly or in small parties in summer, the males generally alone. In the winter they collect into larger herds. The males generally shed their horns in March, and the new horns are not perfect till October, when, as Adams states, "the rutting-season commences and the loud bellowings of the stags are heard all over the mountains." The voice of the Kashmir stag, according to Sir V. Brooke, resembles that of the wapiti, and differs from that of the European red deer. "In the former it is a loud squeal ending in a more guttural tone; in the latter it is a distinct roar, resembling that of a panther."

According to Adams, these deer "are seldom confined to one locality, but roam from forest to forest, preferring grassy glades alternating with dense forest, where there is a copious supply of water." The young are born in April, so the period of gestation must be about six months.

A much larger species than *C. cashmirianus* inhabits one or more wooded upland tracts north of Bhutan, but belonging to Tibet. This stag, *C. affinis* (Hodgson, J. A. S. B. x, p. 721, pl. : xix, pp. 466, 518, pl. ; xx, p. 388, pl. vii), called, but erroneously, the Sikhim Stag by Jerdon, must be excluded from the fauna of British India. It is not found in Sikhim nor in the Chumbi valley, immediately east of Sikhim, but apparently in the next valley to the eastward. Mr. Hume was assured, he tells me, that the area inhabited by *C. affinis* is drained by streams running northward to the Sangpo. The coloration of *C. affinis* resembles that of *C. cashmirianus*. The caudal disk is well marked. The horns are large, 54 inches having been measured, and bear almost always five points each, but the principal distinction from *C. cashmirianus* is in the beam being much bent forward just above the origin of the tree line. The bez is sometimes larger than the brow antler, but less constantly than in *C. cashmirianus*. A skull measures 18.25 inches in extreme length, another 17.5. The basal length of the latter is 16.25, breadth at orbits 7.35. All the skulls I have seen are conspicuously larger than those of *C. cashmirianus*.

The animal to the figure of which, by Duvaucel, Cuvier gave the name of *C. wallichii*, lived in the Barrackpore menagerie, and was said to have been brought from Muktinath near Mount Dwalagiri in Nepal (Hardwicke, Tr. L. S. xiv, p. 581). This place is as nearly as possible halfway between the localities inhabited by *C. cashmirianus* and *C. affinis* respectively. It is difficult to believe that any large deer living in Northern Nepal could have escaped the knowledge of Hodgson's collectors. The shed horns of the type of *C. wallichii* are preserved in Calcutta, and have been figured (J. A. S. B. x, p. 750, pl., fig. 7); they are probably, according to W. Sclater, of the third year, but whether they agree better with those of *C. cashmirianus*, or *C. affinis*, of the stag of Eastern Turkestan, or of any other species, is undecided. The assigned locality must be regarded as very doubtful, and the name must remain in abeyance for the present. *C. narayanus* of Hodgson (J. A. S. B. xx, p. 302, pl. viii), founded on a single horn said to have been brought from Ladak, was probably a young *C. affinis*. No importance need be attached to the supposed locality; no stag is found in Ladak.

Recently, (J. A. S. B. lviii, pt. 2, p. 186, pl. xi) W. L. Sclater has described a deer's dried head (with the skin) and horns purchased in the Darjiling bazaar, and has shown that they agree best with a stag called *Cervus dybowskii* by Taczanowski (P. Z. S. 1876, p. 123), and found in the Ussuri country, N.E. Manchuria, not far from Vlădivostok. Additional evidence may be awaited before supposing that *C. dybowskii* extends to Tibet. It belongs to the Pseudaxine group, without a bez tine and usually with four points on each horn.

A fine elaphine stag inhabits the forests near the rivers east of Yarkand and Kúshgarh, and appears to be nearly allied to the Western Asiatic deer known as *C. maral*, or perhaps identical with it. The great stag of the Thian Shan, for which (P. Z. S. 1875, p. 638, woodcut) I proposed the name of *C. eustephanus*, is a race of the American wapiti, *C. canadensis*, or a closely allied form. The other Asiatic elaphine deer are *C. xanthopygus*, widely distributed, and *C. luehdorfi* from Amoorland, the distinctness of which is doubtful. Besides *C. dybowskii*, *C. sika* from Japan, *C. manchuricus* from Northern China, *C. caspicus* from Northern Persia, and some less known species belong to the Pseudaxine group.

365. *Cervus duvauceli*. *The Bárasingha*.

- Cervus duvaucelii*, Cur. Oss. Foss. ed. 3, p. 505, pl. xxxix, figs. 6-8 (1825); Anon. J. A. S. B. v, p. 240; Sclater, Tr. Z. S. vii, p. 346, pl. xxxvi; Brooke, P. Z. S. 1878, p. 905; W. Sclater, Cat. p. 179. *Cervus bahrainja*, Hodgson, P. Z. S. 1834, p. 99 (no description). *Cervus elaphoides*, Hodgson, J. A. S. B. iv, p. 648, pl. liii, fig. 4 (1835). *Cervus* (Rucervus) *elaphoides*, Hodgson, A. M. N. H. i, p. 154 (1838). *Cervus dimorphe*, Hodgson, J. A. S. B. xii, p. 897, pl. (1843).

- * *Rucervus duvaucelii*, *Hodgson, J. A. S. B.* xvi, p. 689; *Blyth, Cat* p. 150; *id. P. Z. S.* 1867, p. 835, figs. 1-5; *Blanford, J. A. S. B.* xxxvi, pt. 2, pp. 197, 199; *Jerdon, Mam.* p. 254; *Anderson, J. A. S. B.* xxxvi, pt. 2, p. 185, note; *Ball, Stray Feathers*, ii. p. 371.

Bárasingha, Máhá, II.; *Baraya, Gonr, Ghos, Nepal Terai*; *Jhinkar, Kyarda Dún*; *Gqin, Sind &c.*; *Goinjar* ♂, *Gaoni* ♀, Central India; *Bára-Nerwari, Sál-Sámar, Mundla*; *Bhelingi pohu, Assam.* *Swamp deer of Jerdon.*

Size large. Hair moderately fine, rather woolly. Neck maned, tail moderate. Muzzle elongate. No interdigital glands (*Hodgson*). Skull narrow and long; premaxillaries produced considerably beyond the nasals. Horns smooth, with a brow-tine nearly at right angles to the beam, frequently bearing smaller points on its upper surface; sports in the axils are rare. Above the brow-tine the beam is unbranched for more than half its length; it then divides into two, each branch dividing again. In the normal adult horn figured in the accompanying cut the inner branch bears two tines,

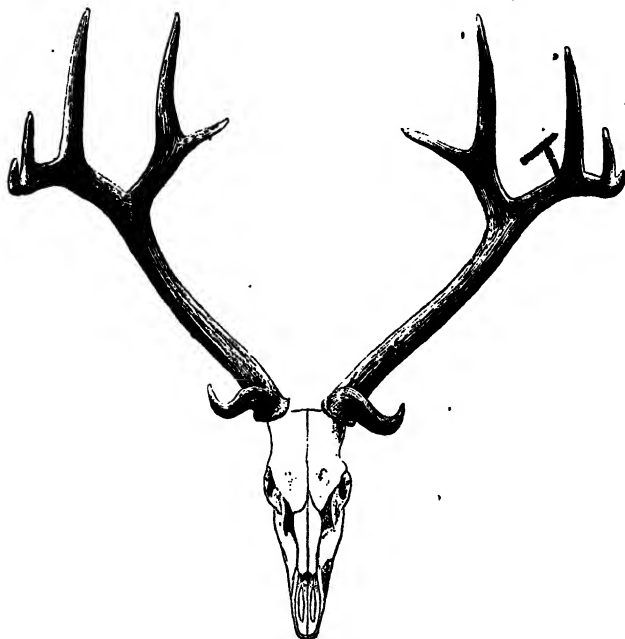


Fig. 175.—Skull and horns of *Cervus duvauceli*. (From a figure by Forsyth.)

the outer three, but this number is often exceeded. Some remarkable horns are figured by Blyth *l. c.*, one pair of them having more than twenty points.

Colour in winter yellowish brown above, paler below, in summer bright rufous-brown usually more or less spotted with white,

especially along the spine, whitish or white on the throat and belly and inside the thighs, and always white beneath the tail. Females paler than males. Young spotted.

Dimensions. Height at shoulder 44 to 46 inches; length nearly 6 feet; tail 8 to 9 inches, without hair 5; ear 7. Extreme length of a skull 15·3, breadth across orbits 6. Large stags in Cooch Behar are said to have weighed from 32 stone 12 lbs. to 40 stone 10 lbs., or 460 to 570 lbs. ('Asian,' April 3rd, 1891). Average horns measure 30 inches round the curve, with a girth of 5 at mid-beam; extreme measurements 38 and 5·25.

Distribution. Along the base of the Himalayas from Upper Assam to the Kyārdā Dūn west of the Jumna, throughout Assam, in a few places in the Indo-Gangetic plain from the Eastern Sundarbans to Bahāwalpur and to Rohri in Upper Sind, and locally throughout the area between the Ganges and Godāvri as far east as Mandla, this deer being common in parts of the Upper Nerbudda valley and to the south in Bastar and the neighbourhood. Forsyth has shown that the range of *C. duvauceli* in the Central Provinces corresponds with that of the sal tree (*Shorea robusta*) and red jungle-fowl (*Gallus bankiva*). In the Donwa valley, 150 miles west of the main sal region, and not far from Pachmarhi, an isolated patch of sal forest contains both this deer and the jungle-fowl. I have seen heads of this stag shot in Upper Sind by General Marston, and there are two on the mosque at Ghotki in the Rohri district.

Habits. The twelve-tined deer is not found in thick forest, but keeps on the skirts of the woods and on flat or undulating grass plains more or less interspersed with trees. It is known as the "Swamp-deer" in parts of North-eastern Bengal, but the term, though used as its English name by Jerdon, is scarcely appropriate. The bārasingha is sometimes met with in open forest. In the winter it is highly gregarious, herds of from thirty to fifty being met with, whilst in Mandla, and probably elsewhere, about September and October, several hundreds sometimes collect. The rutting-season follows. At the end of March in Assam the bucks are found in grass singly, with the horns for the most part partly grown and in velvet, so the old horns must there be shed as a rule not later than February.

This deer feeds chiefly on grass. Forsyth says that it is much less nocturnal than the sāmbar, and although it rests in the shade about midday, it may be found grazing late in the forenoon and again early in the afternoon. Anderson found that a male in confinement was fond of lying in water in the hot season.

I have examined the type of *C. dimorpha*, and ascertained that it belongs to this species and not, as Blyth supposed, to *C. eldi*. Mr. Thomas, I find, had made the same identification.

An allied species, *C. schomburgki* (Blyth, P. Z. S. 1863, p. 155, 1867, p. 835, figs. 6-12), chiefly distinguished by the undivided portion of the beam in each horn being shorter than the branches, is found in Siam and may be met with in the Shan States east of Upper Burma.

366. *Cervus eldi*. *The brow-antlered Deer or Thameng.*

"Nondescript species of Deer," *McClelland, Calc. Jour. N. H.* i, p. 501, pl. xii, figs. 1 a, 1 b.

Cervus eldi, *Guthrie (teste Blyth, P. Z. S.* 1867, p. 837), *Calc. Jour. N. H.* ii, p. 417, pl. xii (1842); *Beavan, P. Z. S.* 1867, p. 759; *Swinhoe, P. Z. S.* 1869, p. 653, figs. 1-3; *Sclater, Tr. Z. S.* vii, p. 348, pls. xxxvii, xxxviii; *Brooke, P. Z. S.* 1878, p. 906; *W. Sclater, Cat.* p. 180.

Cervus (Rusa) frontalis, *McClelland, Calc. Jour. N. H.* iii, p. 401, pls. xiii, xiv (1843); *Blyth, J. A. S. B.* xxviii, p. 296.

Panolia acuticornis, *Gray, List Mam. B. M.* 1843, p. 180 (no description); *Cantor, J. A. S. B.* xv, p. 272.

Panolia platyceros, *Gray, ibid.* p. 181 (no description); *Blyth, P. Z. S.* 1867, p. 842, figs. 20-23.

Panolia eldi, *Gray, Cat. Mam. &c. Nepal & Thibet B. M.* 1846, p. 34; *Blyth, J. A. S. B.* xxx, p. 193, xxxi, p. 334; *id. Cat.* p. 149; *id. P. Z. S.* 1867, p. 835, figs. 13-19; *id. Mam. Birds Burma*, p. 45; *Beavan, J. A. S. B.* xxxv, pt. 2, p. 175.

Sangnai, Sangrai, Manipur; Thameng, Burmese.

Size moderate. Hair very coarse, shaggy in winter, thick and long about the neck in stags. Tail short. Skull elongate, frontal



Fig. 176.—Skull and horns of *Cervus eldi*.

area very narrow; premaxillaries much shorter than in *C. duvauceli*. Horns with an extremely long curved brow-antler joining the beam in such a manner that the two form one continuous curve at right angles to the pedicel. There are frequently small

points on the upper surface of the brow-antler, and generally a prominent snag in the axil. The beam is unbranched for a considerable distance, generally more than half the length, and curved backwards, then outwards, and lastly forwards; towards the end it bears a number of small points from two or three to eight or ten or possibly more, as figured by Blyth (P. Z. S. 1867, l. c.). Curve of the two horns seldom exactly corresponding; those figured on the preceding page are typical, but perhaps with fewer branches than usual. Blyth shows that horns of this deer from Mergui and the Malay Peninsula are shorter and have commonly two or three vertical snags on the brow-antler. In the Siam form (*Panolia platyceros*) the upper part of the beam is flattened and bears several small points on its posterior edge.

Colour. Males in winter are said to be dark brown, almost black, in summer fawn-coloured; does are paler rufous fawn. The lower parts are white in summer, pale brown in winter. No caudal disk. A white mark above the eye is shown in Sclater's figure of the summer garb. The very young are spotted.

Dimensions. Stags about 45 inches, does 42, in height at the shoulders. I can find no other measurements. The basal length of a male skull is 11·75, extreme length 13·4, orbital breadth 5·4. Average horns measure about 40 inches from the tip of the brow-antler to the end of the horn; one of a pair in the British Museum is 54 long, or 35·5 from the burr to the tip; but 38·25 without the brow-antler is said to have been measured. Beavan says that males weigh 210 to 245 lbs., females about 140 lbs.: this is perhaps the weight of cleaned carcasses.

Distribution. The valley of Manipur, and thence southwards in suitable localities throughout Burma and the Malay Peninsula (*Cantor*), also in Cambodia and Hainan, always in flat alluvial ground.

Habits. These have been described by Lieut. Eld (the discoverer of the species) and Captain Beavan. *C. eldi* inhabits grassy and swampy plains, and is usually seen in herds of from 10 to 50 or more; occasionally much larger numbers are found associating. They may enter the fringe of the forest in places for shade during the day, but they generally keep in the open plain. In some places in the Irrawaddy delta, and in Martaban, they are found in plains where, during the dry season, no fresh water is procurable. They are frequently seen in swamps, and feed on wild rice and other plants growing in such places.

The stags commence to shed their horns in June in Manipur; in Lower Burma the horns are lost about September. The rutting-season in Burma lasts from March till May; the young, usually one at a birth, are born in October and November. Males begin to acquire horns in the second year, and are in their prime when about seven years old. The sexes begin to breed at the age of eighteen months.

The call of the female is a short barking grunt, that of the male is lower and more prolonged, and is most frequently heard in the rutting-season.

367. *Cervus unicolor*. *The Sambar or Rusa Deer*.

Middle-sized and Great Axis, *Pennant, Hist. Quad.* p. 106 (1781).
Cervus unicolor and *C. albicoynis*, *Bechstein, Allgem. Uebers. d. vierfüß. Thiere*, i, p. 112 (1799).

Cervus niger, *Blainv. Bull. Soc. Phil.* 1816, p. 76, *teste Blyth, J. A. S. B.* xi, p. 449.

Cervus hippelaphus, *Cuv. Oss. Foss.* ed. 2, iv, p. 40, pl. v, figs. 31–35, 42 (1823); *Duvauzel, As. Res.* xv, p. 157, pl. i (1825); *Elliot, Madr. Jour. L. S.* x, p. 220; *Blyth, J. A. S. B.* xi, p. 449, xx, p. 174; ? *Brooke, P. Z. S.* 1878, p. 903; *W. Sclater, Cat.* p. 179.

Cervus equinus, *Cuv. ibid.* p. 45, pl. v, figs. 37, 38, 46 (1823); *Sykes, P. Z. S.* 1831, p. 104; *Brooke, P. Z. S.* 1878, p. 901.

Cervus aristotelis, *Cuv. Oss. Foss.* ed. 3, iv, p. 503, pl. xxxix, fig. 10 (1825); *Blyth, J. A. S. B.* xi, p. 449; *Brooke, P. Z. S.* 1878, p. 901; *W. Sclater, Cat.* p. 176.

Cervus leschenaultii, *Cuv. ib.* p. 506, pl. xxxix, fig. 9 (1825).

Cervus (*Rusa*) *hippelaphus*, *unicolor*, *aristotelis*, and *equinus*, *Ham. Smith, Griffith's An. Kingd.* iv, pp. 105–112 (1827).

Cervus jarai, *Hodgson, Gleanings in Sc.* iii, p. 321, pl. xxi (1831); *id. J. A. S. B.* i, pp. 66, 115, pl. v.

Rusa jaraya, *nepalensis*, and *heterocervus*, *Hodgson, J. A. S. B.* x, p. 914 (1841) (no descriptions).

Axis pennantii, *Gray, List Mam. B. M.* p. 180 (1843).

Rusa aristotelis, *Gray, List Mam. B. M.* p. 179; *Blyth, Cat.* p. 150; *id. Mam. Birds Burma*, p. 45; *Jerdon, Mam.* p. 256; *Gilbert, Jour. Bomb. N. H. Soc.* iii, p. 224.

Rusa hippelaphus, *Kelaart, Prod.* p. 83.

Rusa equina, *Cantor, J. A. S. B.* xv, p. 271.

Sambar, *Samar*, H.; *Jarao* ♂, *Jarai* ♀, Nepal; *Mahā*, Terai; *Merú*, Mahr. of Ghats; *Ma-ao*, *Mauk*, Gond; *Sáram*, Ilo-Kol; *Kadavé*, *Kadaba*, Can.; *Kennadi*, Tel.; *Kadumai*, Tam.; *Gona Rusa*, Cing.; *Gous*, *Gaoj*, *Bhalongi* ♀, E. Bengal; *Khát-khowa-pohu*, Assam; *Sacha*, Daphla; *Tshat*, Burmese; *Takhau*, *Hseukhau*, *Kheu*, Karen; *Rusa*, *Rusa-etam*, Malay.

The largest Indian deer. Ears large. Hair coarse. Neck and throat of the adult male covered with long hair forming an erectile mane. Muffle large. Orifices of infraorbital glands very large and capable of eversion. Tail moderate. Interdigital glands wanting, according to Hodgson. Molars markedly hypsodont, with small accessory columns. A deep lachrymal fossa; auditory bulla slightly inflated and rugose. Horns each normally with but three tines and very rarely bearing more, irregular points or sports being less common than in most deer; the brow-antler meets the beam at an acute angle; the two upper tines generally subequal in Indian heads, but very variable in form and proportion.

Colour almost uniform dark brown throughout, sometimes greyer, sometimes with a slight yellowish tinge, scarcely paler below. Females and young paler and more rufous than males. Chin, inside of the limbs near the body, lower surface of the tail, and inner part of the buttocks yellower, sometimes all yellowish white. Young not spotted at any stage. Some old males are very dark-coloured, almost black or dark slaty grey.

Dimensions. Height at shoulder of males 48 to 56 inches, and it is said even more; length 6 to 7 feet, tail 12 to 13 inches, ears 7 to 8. Females are smaller. A male skull measures in basal length 14·2 inches, extreme length 15·7, orbital breadth 6·7. A very large stag killed in Cooch Behar is said to have weighed 700 lbs. (51 stone), smaller but still fine male animals about 560 ('Asian,' April 3rd, 1891, p. 3). Horns vary enormously; any over 35 inches in length are of good size, and such are seldom, if

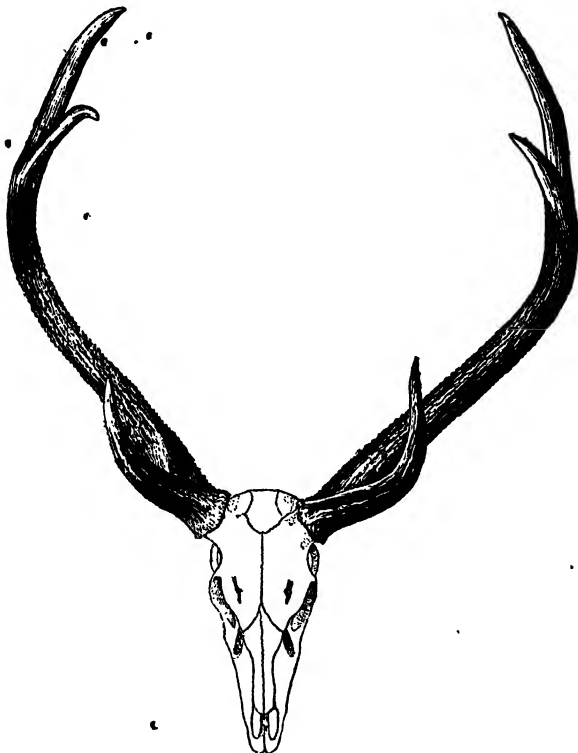


Fig. 177.—Skull and horns of *Cervus unicolor*. (From Forsyth.)

ever, seen out of India. The largest recorded measured 48 inches, but the girth at mid-beam was only 6; horns 35·5 and 38 inches in length have been found to have a girth of 8·25 inches halfway up the beam, and 8·5 has been measured in horns 41 inches long.

Distribution. Almost throughout the Oriental region wherever there is undulating ground or hilly country with forest, but the forms in some of the Malay Islands appear to be specifically distinct. The sambar ascends the Himalayas in places to 9000

or 10,000 feet, and is common on the summits of the ranges in Southern India and Ceylon. It is not common on alluvial flats, though it is occasionally found on them, at considerable distances from any hills. It is, of course, wanting in the treeless plains of the Punjab, Sind, and Western Rajputana.

Varieties and Nomenclature. This fine deer appears to have been first mentioned by Pennant, who described it as the middle-sized and greater Axis (*Cervus axis unicolor* and *C. axis major* of Kerr). To these forms the names of *Cervus unicolor* and *C. albicornis* were applied by Bechstein. Cuvier, in the second edition of his 'Ossements Fossiles,' named different varieties *C. hippelaphus* and *C. equinus*, and two years afterwards added the names of *C. aristotelis* and *C. leschenaultii*, given to horns only. Why the name *C. aristotelis*, given to an abnormal horn, has been preferred for the Indian Sambar it is difficult to say. The name *C. unicolor*, employed by Hamilton Smith, is preferable on account of both priority and suitability, being an appropriate term for the only Indian deer with unspotted young.

Continental forms of sambar do not greatly vary in size, though some Malay Island varieties are very much smaller. Horns from the Himalayas, Assam, and Burma are inferior in size to those from Central India and Bengal. Moreover, whilst in Indian heads the two upper tines generally are nearly equal in length, in Burmese heads the inner tine is considerably shorter than the outer, and the brow-antler is much longer in proportion to the others, as in the Malay form usually called *C. equinus*. The name *C. hippelaphus* is by Brooke and others applied to a Malay variety in which the inner tine is the longer. But all the three names were by Horsfield and others used for varieties found in the Peninsula of India. Elliot showed that these passed into each other, and Blyth, correctly as I believe, united the Himalayan, Burmese, and Malay races with the Indian.

Habits. This is the woodland deer of South-eastern Asia generally, and is more widely and generally distributed than any other species. Although it does not shun the neighbourhood of man to the same degree as *Bos gaurus* does, it is only common in wild tracts of country. It comes out on the grass slopes where such exist, as in the Nilgiris and other hill-ranges, to graze, but always takes refuge in the woods. It is but rarely found associating in any numbers; both stags and hinds are often found singly, but small herds from four or five to a dozen in number are commonly met with. Its habits are nocturnal; it may be seen feeding in the morning and evening, but it grazes chiefly at night, and at that time often visits small patches of cultivation in the half-cleared tracts, returning for the day to wilder parts, and often ascending hills to make a lair in grass amongst trees, where it generally selects a spot well shaded from the sun's rays. It feeds on grass, especially the green grass near water, and various wild fruits, of which it is very fond, but it also browses greatly on shoots and leaves of trees. It drinks, I believe, daily, though

Sterndale doubts this; it certainly travels long distances to its drinking-places at times.

The rutting-season is about October and November in the Peninsula of India, but, according to Hodgson, in spring in the Himalayas.* At that time sámbar collect in larger numbers, and the loud roaring call of the stags is often heard in the morning and evening and sometimes late at night. The period of gestation is eight months, and a single young one is generally born at a time. The horns are usually dropped in March in the Peninsula, and about April in the Himalayas, but all stags do not lose their horns at this time. I have shot them myself in the Central Provinces in April and May with fully developed horns; and Forsyth, who paid particular attention to this characteristic of the sámbar, not only insists upon the fact that stags with perfect horns may be found at all seasons, but declares that individual stags to his knowledge retained their horns for successive years.

The stag's call, already mentioned, is termed by McMaster a "loud and somewhat metallic-sounding bellow," whilst the hind's call, a sharper but fainter note, is described as a "faint grunting low" by the same authority, who has given an excellent account of this animal's habits in his 'Notes on Jerdon.' There is also a sharp snort or cry of alarm caused by the presence of a tiger or panther, or by the sight of man.

The speed of a sámbar is very moderate, and if found on ground where riding is possible, a rare event, any fairly good horse with a rider of moderate weight can catch either stag or hind. All species of *Cervus*, I believe, can be ridden down without much difficulty. I have heard of both spotted and hog deer being speared in favourable localities. Sámbar are usually driven by beaters, or stalked, but in Ceylon it was at one time the practice to hunt them with deer-hounds and kill them with a knife, as described in Sir S. Baker's 'Rifle and Hound in Ceylon.' They are very tenacious of life, and often take several bullets before they fall. Many are killed by tigers and wild dogs. The stags fight much amongst themselves, the brow-antler, as in all deer, being the principal weapon of offence, and the wound it inflicts has the reputation of being very deadly. The flesh of the sámbar is coarse, but well-flavoured, the marrow-bones and tongue being usually retained by sportsmen for themselves; but as most Hindoos will eat deer with antlers, the meat is seldom wasted in India, as that of wild cattle and pigs often is.

368. *Cervus axis*. The spotted Deer.

Cervus axis, *Erxl. Syst. Reg. An.* p. 312 (1777); *Elliot, Mad. Jour.* L. S. x, p. 221; *Blyth, J. A. S. B.* xi, p. 1202, xxii, p. 415; *Brooke, P. Z. S.* 1878, p. 907; *Ravenscroft, P. Z. S.* 1883, p. 465; *W. Sclater, Cat.* p. 181.

Cervus nudipalpebra, *Ogilby, P. Z. S.* 1831, p. 136.

Axis major and minor, Hodgson, J. A. S. B. x, p. 914 (1841), no descriptions; xvi, pp. 691, 711; xvii, pt. 2, p. 486.

Axis maculata, Gray, *List Mam. B. M.* p. 178 (1843); Kelaart, *Prod.* p. 82; Adams, *P. Z. S.* 1858, p. 530; Blyth, *Cat.* p. 152; Jerdon, *Mam.* p. 260.

Chital, *Chitra*, *Jhánk*, H.; *Chajdah*, Bhágalpur; *Boro khotiya*, Beng., Rungpore; *Buriya*, Gorakhpur; *Lupi*, Kars, Gond; *Dárkár*, Korku; *Pásta*, Ho-Kol; *Sárung*, *Sáraga*, *Jati*, *Mikka*, Can.; *Dupi*, Tel.; *Pati-man*, Tam. Mal.; *Tic Muha*, Cing.

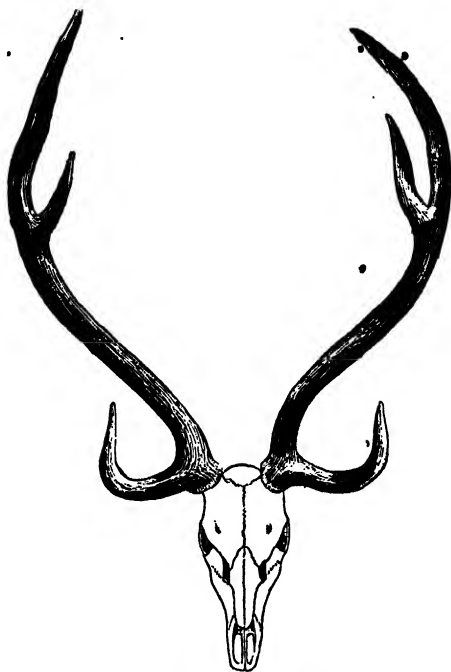


Fig. 178.—Skull and horns of *Cervus axis* (horns after Forsyth).

Size moderate. No mane. Molars very hypsodont. Muffle as in *C. unicolor*. Tail long, pointed. Interdigital glands in hind feet only (Hodgson). Upper canines generally wanting (Hodgson states that he has found them in both sexes). Horns normally with three tines, a brow-antler which joins the beam at rather less than a right angle, and two upper tines of which the outer is always much the longer. Sports or irregular points in the axil of the brow-tine very common; few fine horns are without them, but other additional points are rare.

Colour rufous fawn, spotted throughout the body with white at all seasons and all ages. A dark dorsal stripe from nape to end of tail, bordered by a single or double row of white spots on the back. Low down on the sides the white spots sometimes blend into a

horizontal line. Chin and upper throat, belly, inside of limbs, and lower surface of the tail white. Head brownish unspotted, the face darker. Ears brown outside, white within. A melanoid variety indistinctly spotted occasionally occurs (*C. nudipalpebra*).

Dimensions. Height of males at shoulder 36 to 38 inches in Central and Northern India, length $4\frac{1}{2}$ to 5 feet. A female measured 30 inches high, 53 long; tail with hair $12\frac{1}{2}$, without 10. In Southern India the height is considerably less, 30 to 34 inches according to Jerdon. But an Anaimalai male measured by Hornaday was nearly 36 inches high, 62 long, and weighed 145 lb. Basal length of a large male skull 9.75, orbital breadth 4.7. Horns of the larger variety have been measured 38 and 38.75 inches long round the curve, with a girth of 4 at mid-beam and 5.75 at the base above the burr. Ordinary horns measure about 30 in length, but heads from Bengal and Southern India are generally smaller.

Distribution. The spotted deer is found nearly throughout India and Ceylon. It occurs at the base of the Himalayas, not, however, ascending the mountains beyond the lower spurs, from the neighbourhood of the Sutlej to Nepal, but not in Sikhim. It is not found in the Punjab plains, nor in Sind, and only to the eastward in Rajputanā; it is wanting also in Assam and to the east of the Bay of Bengal, but common in the Sundarbans, apparently as far east as Mymensing (J. A. S. B. xxii, p. 415), throughout Bengal and Orissa, the N.W. Provinces, Central India, Mysore, Malabar, and Ceylon, in all suitable localities. It ascends the hills of S. India in places to about 3500 or 4000 feet.

Varieties. With the exception of the rare melanoid form already mentioned, the only variation, so far as I know, is in size. The spotted deer of Lower Bengal, Malabar, Southern India, and Ceylon are considerably smaller than those of the North-west and Central Provinces, and of the hills of Orissa and Vizagapatam. Hodgson proposed the name of *Axis minor* for the smaller race, and Jerdon was inclined to regard it as distinct, but there is now a general agreement that the two forms are merely local varieties.

Habits. The especial habitat of this deer, perhaps the most beautiful in form and coloration of the whole family, is amongst bushes and trees near water, and in bamboo-jungle. The spotted deer is found both in hilly ground and on alluvial plains. It never goes far from its drinking-places. So long as it has a wild tract of bush or ravines for shelter, it appears to care little for the neighbourhood of man. Many of its favourite haunts are in some of the most beautiful wild scenery of the Indian plains and lower hills, on the margins of rippling streams with their banks overgrown by lofty trees, or in the grassy glades that open out amidst the exquisite foliage of bamboo clumps. Spotted deer are thoroughly gregarious and associate at all times of the year in herds, sometimes of several hundreds. They are less nocturnal than sambar, and may be found feeding for three or four hours after sunrise, and again in the afternoon for an hour or two before

sunset. They generally drink between 8 and 10 o'clock in the morning, the time varying with the season of year, and repose during the day in deep shade. They swim well, and take readily to water. They both graze and browse.

There is, I believe, much variation in the rutting-season, which, according to Hodgson, begins in September. It is generally in the cold season in Northern India, but I am under the impression that young fawns are born almost throughout the year. Certainly there is great irregularity as to the period of dropping the horns, and bucks with perfect antlers may be found at all seasons. The call of the spotted deer is a peculiar, loud, hoarse barking sound, easily recognized but difficult to describe. This deer also utters a shrill alarm cry. The period of gestation is 8 months (P. Z. S. 1863, p. 230), or 6 according to Hodgson (J. A. S. B. xvi, p. 691). The flesh is dry as a rule, but if kept till tender is excellent.

369. *Cervus porcinus*. *The Hog-deer*.

Cervus porcinus, Zimm. *Spec. Zool. Geog. Quad.* p. 532 (1777); McClelland, P. Z. S. 1839, p. 150; Hutton, J. A. S. B. xv, p. 150; Brooke, P. Z. S. 1878, p. 902; W. Sclater, p. 178.

Hyelaphus porcinus, Sundevall, *Kong. Vet. Ak. Handl.* 1844, p. 181; Adams, P. Z. S. 1858, p. 530; Blyth, *Cat.* p. 153; *id.* *Mam. Birds Burma*, p. 45.

Axis oryzus, Kelaart, *Prodr.* p. 83 (1852); Blyth, J. A. S. B. xxiii, p. 217.

Axis porcinus, Jerdon, *Mam.* p. 262.

Párá, Il. (also Sindhi and Punjābi); *Dodar*, Rohilkund; *Khár laguna*, Nepal Terai; *Nutrini haran*, Beng.; *Wíl-muha*, Cing.; *Darai* or *Dayai*, Burmese.

Size small. Legs shorter in proportion. Tail rather long. Frontal region of skull narrow. No upper canines. Horns small, on longish pedicels. Each horn with 3 tines, the brow-antler meeting the beam at an acute angle, outer upper tine exceeding the inner.

Colour. Brown, more or less rufous or yellowish, the hairs with pale tips, producing a minutely speckled appearance. Lower parts paler. Ears white inside, and tail white beneath. In summer the fur is paler, more rufous and more or less spotted with pale brown or white. The spots are probably not always developed, and they soon disappear: they are sometimes limited to one or two rows on each side of a dark dorsal stripe. Some doubt has been expressed as to whether adults are ever spotted, but I watched the assumption of the spotted summer garb for 2 or 3 years in several adults kept in the Calcutta Zoological Gardens. The young up to about six months old are spotted throughout the body.

Dimensions. Height at shoulder about 24 inches; length from muzzle to root of tail 42 to 44, tail with hair 8. A male skull measures 8.6 in basal length by 4.1 in orbital breadth. The horns are generally small, and do not often exceed 10 or 12 inches in

length. The longest recorded are a little over 20 inches long with a girth at mid-beam of 3·5.

Distribution. In the Indo-Gangetic plain everywhere from Sind and the Punjab to Assam. The hog-deer is common in the Terai, but never ascends the hills. It is found also in Sylhet and throughout Burma to Tenasserim in alluvial flats. It may range some distance into the Peninsula along the course of the Gangetic tributaries like the Soane; but although it is said by Forsyth to be found in the Central Highlands east of Mandla, and by Ball to

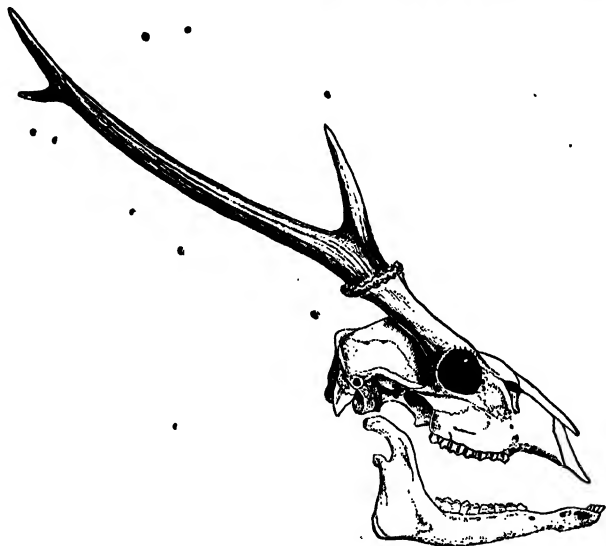


Fig. 179.—Skull and horn of *Cervus porcinus*.

have been seen by him distinctly in Jeypore near Vizagapatam, I think the existence of the animal in both localities needs confirmation. As a rule, it is certainly not found in the Peninsula of India; reports of its occurrence in parts of the Bombay and Madras Presidency being due to the use of the term Hog-deer for *Tragulus meminna* and perhaps for *Cervulus muntjac*, on account of their bearing tusks. Some true hog-deer occur in Ceylon, but are confined, as I learn from Mr. Hugh Nevill, to a small area between Matura and the Kaltura River, and have almost certainly been introduced.

Habits. The hog-deer is an inhabitant of alluvial plains, and is almost if not quite restricted to them. It abounds in some of the grass-jungles, keeping as a rule to grass of moderate height, mixed with tamarisk and other bush, rather than to the masses of grass 12 to 30 feet in height that form the favourite haunt of the buffalo and rhinoceros. It is sometimes found amongst high trees, but not so often as on grassy plains. Hog-deer are not

gregarious, it being rare to find more than two or three together, though several may be met with in the same small tract. As a rule, however, individuals of both sexes are solitary. These animals are somewhat ungainly in their movements; they run awkwardly, with the head low. As already stated, they have frequently been speared, but generally give a good run before being caught; they are naturally more often found on ground suitable for riding than other Indian deer. Generally they are shot off elephants. The rutting-season is in September and October according to Jerdon. The period of gestation is 8 months (P. Z. S. 1863, p. 230). The bucks drop their horns generally in April.

Subfamily MOSCHINÆ.

No horns in either sex. A gall-bladder present, as in the *Bovidae*. A simple orifice to the lachrymal canal, situated just within the anterior margin of the orbit. Hemispheres of brain but slightly convoluted. Cotyledons of placenta arranged in a peculiar linear order. A single genus.

Genus MOSCHUS, L. (1766).

Upper canines in both sexes, greatly developed in males and projecting considerably beyond the mouth. Skull very similar in

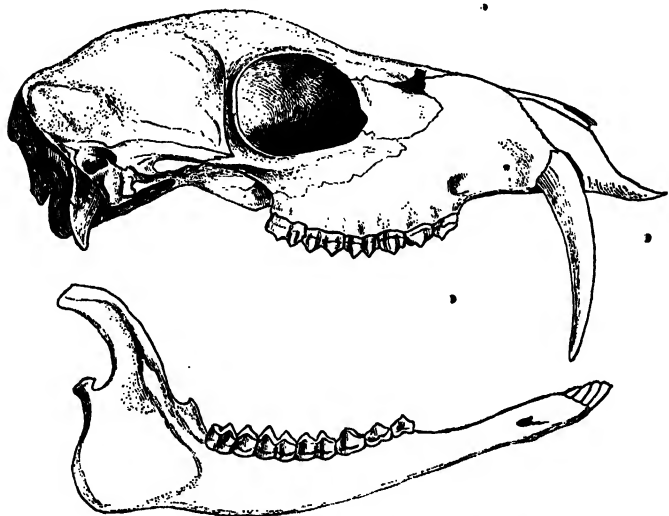


Fig. 180.—Skull of *Moschus moschiferus*.

form to that of *Cervus*. Outer metatarsals wanting; the distal extremities of the outer metacarpals present; all the outer toes

have well-developed phalanges. No infraorbital or interdigital glands. A peculiar sac-like gland in the male, situated beneath the skin of the abdomen, immediately in front of the preputial aperture. This is the musk-gland. Campbell (J. A. S. B. vi, p. 118) and Hodgson (*op. cit.* x, p. 795) have described another gland with an elliptical orifice on each side beneath the tail, also peculiar to the male. Vertebra: C. 7, D. 14, L. 5, S. 5, C. 6.

The anatomy has been described by several writers, especially Pallas (*Spic. Zool.* xiii, 1779), Campbell and Hodgson *l. c.*, Flower (P. Z. S. 1875, p. 159), and Garrod (P. Z. S. 1877, p. 287).

Several species have been proposed on account of differences in coloration, but these distinctions appear due to individual variation. Recently Büchner has described an additional species from Kansu, east of Tibet, as *M. sifaniensis*.

370. *Moschus moschiferus*. *The Musk-deer.*

Moschus moschiferus, L. *Syst. Nat.* i, p. 91 (1766); Hutton, J. A. S. B. vi, p. 935; Hodgson, J. A. S. B. xvi, p. 693, xvii, pt. 2, p. 486; Adams, P. Z. S. 1858, p. 523; Blyth, *Cat.* p. 157; Jerdon, *Mam.* p. 266; A. Milne-Edw. *Ann. Sc. Nat.* (5) ii, p. 154, pl. iv, fig. 1; *il. Rech. Mam.* p. 176, pls. xix, xx; Blanford, J. A. S. B. xli, pt. 2, p. 39; Lydekker, J. A. S. B. xlv, pt. 2, pp. 286, 287, xlix, pt. 2, p. 4; Scully, P. Z. S. 1881, p. 209; W. Schlater, *Cat.* p. 172.

Musk-deer, Hodgson, *Gleanings Sc.* iii, p. 320, pl. xxi (young).

Moschus chrysogaster, *leucogaster*, and *saturatus*, Hodgson, J. A. S. B. viii, p. 203, xi, p. 285.

Kastura, *Mushk*, H.; *Rāos*, *Rous*, Kashmir; *Lá*, *Lawa*, Tibetan; *Ribjo*, Ladak; *Bena*, *Masak nábu*, Garhwál and Kumaun.

Hair of peculiar texture—long, coarse, brittle, minutely wavy, and composed of a substance resembling pith. Limbs long, the hinder considerably the longer. Hoofs narrow, pointed; lateral hoofs greatly developed. Ears large. Tail very small, glandular, and marked with a terminal tuft in males, hairy in females. The canines in the male are frequently 2 to 3 inches in length.

Colour rich dark brown, more or less speckled and mottled with grey, the hairs having a subterminal white ring and blackish tips. The basal three-fourths or more of the hair on the body is white. Lower parts and inside of limbs paler; chin, inner borders of ears, and inside of thighs whitish; a white spot in some (the young?) on each side of the throat. Some individuals are paler, others yellowish in tint. Hodgson's variety *chrysogaster* is described as bright sepia-brown above, sprinkled with golden red, and the lower parts golden red or orange. Adams describes another form as "very dark on the upper parts with black splashes on the back and hips, underparts white or a dirty white." This corresponds to Hodgson's *leucogaster*. Others, he says, "are of a yellowish white all over the upper parts, with the belly and inner sides of the thighs white." Jerdon mentions a Kashmir variety with

grizzled grey spots in lines on the back. The young are spotted with white, or yellowish white; those from Kashmir are much paler in colour than Eastern Himalayan individuals.

Dimensions. Height of male at shoulder about 20 inches, at croup about 22; length, nose to rump, 36; tail without hair $1\frac{1}{2}$ to 2; ear 4; weight of a female about 20 lbs. A male skull measures 5.15 in basal length, 2.7 in breadth across the orbits.

Distribution. Throughout the Himalayas as far west as Gilgit, at elevations exceeding 8000 feet (in Sikkim in the summer above 12,000); in forest and brushwood. Also in Tibet and other parts of Central Asia as far north as Siberia.

Habits. The musk-deer is a solitary animal, more than two being seldom if ever seen together. It frequents wooded slopes, often very steep, and, as Kinloch says, resembles a hare in its habits, making a "form" in which it remains throughout the day, and moving about to feed in the mornings and evenings. It is very active and surefooted, its large lateral hoofs apparently giving it the means of holding on to slippery and precipitous rocks, and it progresses by a series of bounds, sometimes of great extent. It is by no means shy where it has not been much hunted.

The food of the musk-deer is, by Adams, said to consist of grass and lichens, by Kinloch of leaves and flowers. This animal's fur is admirably adapted as a defence against cold. According to Adams, no cry has been observed, even in the rutting-season; the only sound this animal has been known to make is a series of harsh screams that it utters when captured.

The breeding-habits were observed by Hodgson in a pair kept in captivity at Katmandu. The rutting-season was in January, the period of gestation about 160 days, and a single young one was born in June. Two are sometimes, but not usually, produced; the young procreate before they are a year old.

The musk, the contents of the abdominal gland, is only developed at the rutting-season, and is a brown soft mass with a peculiar well-known odour. An ounce is about the average produce of one animal. Many musk-deer are snared in nooses, others shot to secure the "musk-pod," which is an article of commerce. The flesh of the animal is excellent, and free from any musky flavour.

TRAGULINA.

Family TRAGULIDÆ.

This being the only family of the present section, the characters may be given under one heading. The dentition is i. $\frac{0}{3}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$, as in most *Cervidæ*. The fibula is complete. There are four toes, with fully developed phalanges and metapodials on all feet, the middle metapodials generally confluent. Navicular, cuboid, and ecto-cuneiform bones of tarsus united. The members of this section are true ruminants, but the stomach is composed of only three distinct compartments, the manyplies or third cavity of the *Pecora* being rudimentary. Placenta diffused.

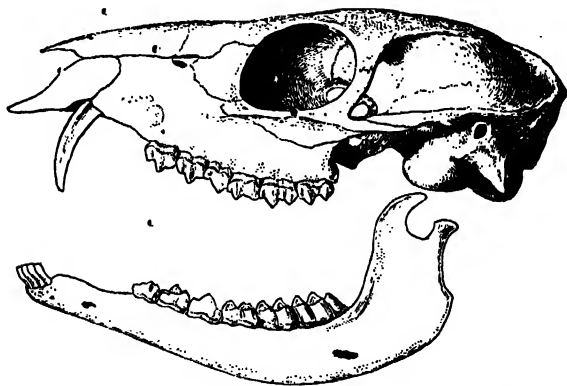


Fig. 181.—Skull of *Tragulus meminna* ♂, $\times \frac{1}{3}$.

The *Tragulidæ* are small animals with very slender limbs and high hind-quarters, inhabiting forests. Of the only two living genera one, *Dorcatherium* (*Hyomoschus*), is West-African, the other, *Tragulus*, is Oriental. The type is less specialized than that of the *Pecora*, and it is not surprising to find many extinct forms of *Tragulina* in the Upper Eocene and Miocene of Europe and America, whilst in India two species of *Dorcatherium* (now peculiar to Africa) and one of *Tragulus* have been described from the Pliocene Siwaliks.

Genus **TRAGULUS**, Brisson (1756), partim.

Syn. *Meminna*, Gray.

Size small or very small. Metapodials confluent. A large muffle occupying the terminal portion of the muzzle. No infraorbital,

interdigital, or inguinal glands. Skull elongate and compressed anteriorly; occiput narrow. Brachydont and selenodont; premolars with a pointed triangular crown, the profile becoming almost tri-cuspid with age; upper canines in males long, exserted, short in females. Mammæ 4. Hair in all species fine and close.

Synopsis of Indian, Ceylonese, and Burmese Species.

- a. Body spotted; chin and throat hairy *T. meminna*, p. 555.
 b. Body not spotted; skin between rami of
 mandible naked.
 a'. Larger; hind foot and tarsus 5·8 to 6
 inches *T. napu*, p. 557.
 b'. Smaller; hind foot and tarsus 4·4 to 5
 inches *T. javanicus*, p. 556.

371. *Tragulus meminna*. *The Indian Chevrotain or Mouse Deer.*

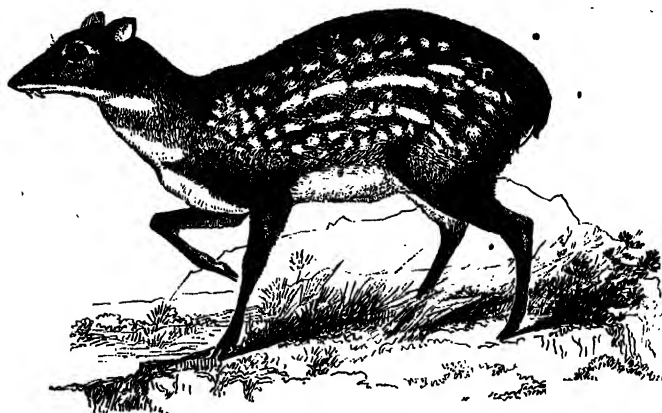


Fig. 182.—*Tragulus meminna*.

Moschus meminna, *Erl. Syst. Regn. An.* p. 322 (1777); [Sykes, *P. Z. S.* 1831, p. 104; Elliot, *Mad. Jour. L. S.* x, p. 220; Tickell, *Calc. Jour. N. H.* i, p. 420; Blyth, *J. A. S. B.* xi, p. 96.

Meminna indica, Gray, *List Mam. B. M.* 1843, p. 172; Kelaart, *Prod.* p. 81; Blyth, *Cat.* p. 155; *id.* *P. Z. S.* 1864, p. 483; Jerdon, *Mam.* p. 269.

Tragulus meminna, A. Milne-Edwards, *Ann. Sci. Nat.* (5) ii, p. 160, pl. iii, fig. 2, pl. x; W. Selater, *Cat.* p. 189; Thomas, *P. Z. S.* 1891, p. 385.

Pisura, *Pisora*, *Pisai*, H., Mahr.; *Jitrai haran*, Beng.; *Gandwa*, Uria; *Yar*, Ho-Kol; *Kuru-pandi*, Tel.; *Kuram-pani*, Tam.; *Kur-pandi*, Can.; *Walmuha*, Cing.

No naked glandular area on throat. Tarsus hairy all round, except behind close to the hock. Tail short.

Colour. Upper parts brown, darker or paler, minutely speckled with yellow; the hairs brown at the base, black towards the end,

with a yellow ring a short distance from the tip. Sides spotted with white or buff on a brown ground, the spots elongate and passing into longitudinal bands. Lower parts white; throat with 3 white stripes, one in the middle pointed in front, and an oblique one on each side.

Dimensions. Height at shoulder 10 to 12 inches, length from nose to base of tail 18 to 22 inches, tarsus and hind foot about 5·3, tail 1 to 1·5: weight 5 to 6 lb. A good-sized male skull from the Shevroy hills measures 4·5 in extreme, and 3·85 in basal length, and 2 in zygomatic breadth.

Distribution. Ceylon and Southern India in forest at elevations below 2000 feet, extending northwards to Orissa, Chutia Nágpur, and the Eastern Central Provinces; also along the Western Gháts to north of Bombay. I have never heard of this animal in Bengal proper, Behar, the North-west Provinces, Rajputana, the Bombay Deccan away from the Western Gháts, Berar, nor the Central Provinces west of Jubbulpore, Seoni, and Nágpur (Sterndale has recorded its occurrence near Seoni). Hodgson included it in his list of Nepal mammals, but appears never to have obtained a specimen, though Blyth refers to a Nepalese specimen in his Catalogue. I think the occurrence of this species in Northern India requires confirmation. If it occurs, it must be very rare. Jerdon also questioned its existence to the northward.

Habits. A good account is given by Tickell. He says this species "is found throughout the jungly districts of Central India (*i. e.* Chutia Nágpur), but from its retired habits is not often seen. It never ventures into open country, but keeps among rocks, in the crevices of which it passes the heat of the day, and into which it retires on the approach of an enemy. In these the female brings forth her young, generally two in number, at the close of the rains or the commencement of the cold season. The male keeps with the female during the rutting-season (about June or July), at other times they live solitary."

Like all the *Tragulidæ* this animal has a peculiar walk on the tips of its hoofs, which gives the legs a rigid appearance, and there is a common idea that it has no knee-joints. It is timid, but gentle and easily domesticated, and has bred in confinement. The only sound it has been observed to utter is a feeble bleat. It is crepuscular in its habits.

372. *Tragulus javanicus*. *The little Malay Chevrotain*.

Moschus javanicus, *Gmelin, Syst. Nat.* i, p. 174 (1788).

Moschus kanchil, *Raffles, Tr. L. S.* xiii, p. 262; *Gray, P. Z. S.* 1836, p. 64.

Tragulus kanchil, *Gray, List Mam. B. M.* p. 173; *Cantor, J. A. S. B.* xv, p. 268; *Blyth, J. A. S. B.* xxvii, p. 276; *id. Cat.* p. 156; *A. Milne-Edw. Ann. Sci. Nat.* (5) ii, pp. 111, 159, pl. ii, fig. 3, pl. ix; *Blyth, P. Z. S.* 1864, p. 483; *id. Mam. Birds Burma*, p. 44; *Thomas, P. Z. S.* 1886, pp. 72, 79; *W. Sclater, Cat.* p. 189.

Tragulus javanicus, A. Milne-Edw. t. c. pp. 103, 157, pl. ii, fig. 1;
Blyth, P. Z. S. 1864, p. 483; Thomas, P. Z. S. 1891, p. 385.

Tragulus pelandoc, Blyth, J. A. S. B. xxvii, p. 277; *id.* Cat. p. 156.
Yun, Burmese; Kanchil, Pelandoc, Malay.

A naked glandular area beneath the chin, between the rami of the mandible; tarsus naked behind throughout, carpus almost naked behind. Tail long.

Colour. Above brown, more or less rufous. Back in old individuals nearly black, but always more or less mixed with rufous or yellow, from some of the hairs having a yellow ring near the end. Hair at base light brown. Sides paler; nape and upper surface of neck almost or quite black, contrasting with the light brown of the sides. Lower parts white, variously mixed with light rufous and usually with a median narrow brown or rufous line throughout the breast, in front of this is a brown cross band and on the fore neck an arrowhead-like brown mark, sometimes imperfect, with three white stripes, one median, within the arrow-head, the other two diverging, one on each side, outside of it; the last two joining on the throat. Rump rufous, inside of thighs and intermediate space always white; tail rufous-brown above, white below.

Dimensions. The largest adults measure: nose to root of tail 18·5 inches, tail 3 (Cantor), tarsus and hind foot 4·4 to 5. Basal length of a male skull 3·4, extreme length 3·95; zygomatic breadth 1·9.

Distribution. Malay Peninsula and Islands, extending as far north as Yai in Tenasserim, also to Cambodia and Cochin China. This species is common in Sumatra and Java..

Habits. Very similar to those of *T. meminna*. This chevrotain inhabits dense thickets and is said to be very abundant in the mangrove-jungle along the coast of Tenasserim and the Malay Peninsula. It is timid and very delicate, though it is easily tamed, and occasionally has been known to breed in confinement. It produces one or two young at a time. Except the Royal Antelope, *Nanotragus pygmaeus*, the present is the smallest living Ungulate.

373. *Tragulus napu*. The larger Malay Chevrotain.

Moschus javanicus, Raffles, Tr. L. S. xiii, p. 262; Gray, P. Z. S. 1836, p. 64; *nec* Gmelin.

Moschus napu, F. Cuv. Hist. Nat. Mam. pl. 329 (1822).

Tragulus javanicus, Gray, List Mam. B. M. 1843, p. 173; Cantor, J. A. S. B. xv, p. 269; Blyth, J. A. S. B. xxvii, p. 277; *id.* Cat. p. 155.

Tragulus fuscatus, Blyth, J. A. S. B. xxvii, p. 278.

Tragulus napu, A. Milne-Edw. An. Sci. Nat. (5) ii, pp. 103, 158, pl. ii, fig. 2, pl. viii; Blyth, P. Z. S. 1864, p. 483; Blanford, J. A. S. B. xlvii, pt. 2, p. 166; Thomas, P. Z. S. 1886, p. 71, 1891, p. 385; W. Slater, Cat. p. 190.

Napu, Malay.

A naked tract on the throat, the tarsus naked behind, and the tail long as in *T. javanicus*. Size larger.

Colour. Upper parts yellowish or rufous-brown, sides greyer: Hair on back light brownish orange with black tips, no subterminal pale ring. On the sides the basal portion of the hair is whitish. Forehead and nape blacker, but the borders of the black area ill-defined. Lower parts white, generally a brown median line on the breast, the chest and lower abdomen white and an intermediate tract brownish. Throat and fore neck brown, with 5 white bands more or less distinct, a median band on the chest and two oblique lines on each side in front on the throat. The white lines often become blended together. Rump rufous; tail brown above, white below.

Dimensions. Height 13 inches, nose to root of tail 28, tarsus and hind foot 5·6 to 6, tail 5. I have been unable to obtain the measurements of an adult skull; those of the figure in Milne-Edwards's paper are: extreme length 4·5 inches, basal length 4, breadth 1·9, but these are probably small.

Distribution. The Malay Peninsula, extending north into Southern Tenasserim, and south to Sumatra, Java, and Borneo. This species was obtained at Bankasún in S. Tenasserim by Mr. W. Davison.

Habits. So far as is known similar to those of the other species, but the larger chevrotain is much less common in the Malay Peninsula than *T. javanicus*.

The *Tylopoda*, or Camels and Llamas, form a separate section of the ruminant Artiodactyle Ungulates. They differ from other ruminants in dentition, the full number of upper incisors being present in the young and the outermost being persistent throughout life. The canines are present in both jaws, and the lower canines are distinct from the long procumbent and spatulate incisors. The molars are selenodont and hypsodont, but one or more of the anterior premolars is usually detached from the series and pointed. Only two digits, the third and fourth, are present in each foot, and there are no true hoofs, the ungual phalanges bearing nails and the sole of the foot consisting of a broad fleshy pad. There are no horns. There is no distinct third compartment of the stomach or manyplies, the interior of the rumen or paunch has no villi on the surface, and both it and the second compartment have within their walls large pouches or cells in which water can be retained. The placenta is diffuse.

There are two living genera, *Camelus* and *Lama* (*Auchenia*), the latter South American. Only two species of camel exist—*Camelus bactrianus*, the two-humped camel, found tame in Central Asia; and *C. dromedarius*, the single-humped camel, so extensively employed in South-western Asia and Northern Africa. This is the animal of which large herds are kept in North-western India. It is unknown in the wild state, and although Bactrian Camels have been found wild by Prejvalski and others in the deserts east of Yarkand, there is but little doubt that these wild individuals are descended from tame ancestors. Fossil remains of camels belonging to two extinct species are found in the Pliocene Siwaliks of Northern India.

SUINA.

Molars bunodont, bearing, when unworn, cone-like tubercles, and exhibiting when worn a pattern not arranged in crescents. Not ruminant. Third and fourth metapodials not completely united to form a cannon-bone (fig. 157 c, p. 480). Upper incisors present.

Only one family is represented in India.

Family SUIDÆ.

An elongate snout, terminating in an expanded, truncated, nearly naked, flat disk containing the nostrils. Feet narrow; four completely developed toes in each, the hoofs of the outer two not reaching the ground in the ordinary walking position. Teeth variable in number. Incisors rooted. Upper canines curving more or less outwards and upwards. Stomach simple. A cæcum present.

The family of the pigs is distributed throughout the greater part of Europe, Asia, and Africa. These animals are amongst the least specialized of living Ungulates and are represented by a great number of extinct species, extending back to the Miocene and Upper Eocene. In Indian Pliocene and Pleistocene beds six or seven species of *Sus* alone are found, one of them the largest of known pigs, besides species of *Hyotherium*, *Hippohyus*, &c. In addition to members of the *Suidæ*, numerous forms are met with that tend to unite the non-ruminant *Suina* with the ruminant *Pecora*, especially pigs with selenodont molars (*Anthracotherium* &c.). Amongst the most remarkable pig-like forms is *Tetraconodon*, an animal about the size of a tapir with enormous conical premolars.

The Indian living species belong to the typical genus.

Genus *SUS*, L. (1766).

Syn. *Porcula*, Hodgson (1847).

The complete dentition of the Eutheria is present:—i. $\frac{6}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{4-4}$, m. $\frac{3-3}{3-3}$. Upper incisors diminishing rapidly in size from the median pair to the outer. Lower incisors long, narrow, projecting almost horizontally. Canines (tusks) greatly developed in males, rootless, both upper and lower curved outwards and projecting from the mouth in males, the upper turned upwards. Teeth of molar series increasing in size and complexity from the

first to the last, first lower premolar separated from the second by an interval. Last molar nearly or quite as long as the two preceding it together. Vertebrae: C. 7, D. 13-14, L. 6, S. 4, C. 20-24.

Skull elongate, the occipital crest greatly elevated, so that in the profile the occiput makes an acute angle with the line of the face. Nasals very long and narrow; a peculiar prenasal bone.

True pigs are found throughout the Oriental region and the temperate portion of the Palearctic, and are represented by the subgeneric form *Potamochoærus* in Africa and Madagascar. Three species occur within Indian limits.

Synopsis of Indian, Ceylonese, and Burmese Species.

Large; height at shoulder 30 to 40 inches.... *S. cristatus*, p. 560.
 Small; height about 20 inches..... *S. andamanensis*, p. 562.
 Very small; height about 10 inches..... *S. salvanius*, p. 563.

374. *Sus cristatus*. The Indian wild Boar.

Sus cristatus, *Wagner, Münch. gel. Anz.* ix, p. 535 (1839); *Blyth, Mam. Birds Burma*, p. 43; *W. Sclater, Cat.* p. 193.

Sus scrofa, *Sykes, P. Z. S.* 1831, p. 104; *Elliot, Mad. Journ. L. S.* x, p. 219; *Blyth, Cat.* p. 139; *Ikanford, J. A. S. B.* xxxvi, p. 197 (*nec Linn.*).

Sus indicus, *Gray, List Sp. Mam. B. M.* p. 185 (1843); *Cantor, J. A. S. B.* xv, p. 261; *Kelaart, Prod.* p. 78; *Jerdon, Mam.* p. 241.

Sus affinis, *Gray, List Ost. Sp. B. M.* (1847), p. 71 (no description).

Sus zeylonensis, *Blyth, J. A. S. B.* xx, p. 173; xxi, p. 351.

Sus bengalensis, *S. indicus*, and *S. zeylanensis*, *Blyth, J. A. S. B.* xxix, p. 105.

Suar, *Barha*, *Bad* or *Bura jānwar*, Il.; *Dūkar*, *Mahr.*, *Guz.*, *Sind.*; *Hikk*, *Baluch*; *Gūráz*, *Kuk*, P.; *Pandi*, *Tam.*, *Tel.*, &c.; *Katu-pani*, *Tam.*; *Paddi*, *Gond*; *Bir Sukri*, *Ilo-Kol*; *Kis*, *Rájmehál* hill tribes; *Handi*, *Mikka*, *Jevadi*, *Kari-játi*, *Can.*; *Sukaram*, *Mal.*; *Walura*, *Cing.*; *Banel*, *Nepal.*; *Ripha*, *Phák*, *Bhotia*; *Sarao*, *Daphla*; *Bali*, *Techim*, *Mishmi*; *Sniang*, *Khási*; *Vák*, *Gáro*; *Omar*, *Hono*, *Kachári*; *Kubak*, *Tharo*, *Kashag*, *Mengi*, *Vák*, *Nága*; *Eyeg*, *Ahor*; *Mu*, *Khámti*; *Ok*, *Manipur*; *Vu*, *Kuki*; *Vhu*, *Aka*; *Wa*, *Singpho*; *Tau wet*, *Burm.*; *Kalet*, *Talain*; *Hto*, *Karen*; *Mu*, *Shan*; *Bábi úlan*, *Malay*.

A crest of lengthened black bristles from the nape along the back. Hair coarse and bristly throughout, thin on the sides, and still thinner below. No woolly underfur. Tail extending nearly to hocks, scantily haired except at the tip, which is compressed and fringed on each side. Ears thinly clad externally, more thickly within. The last lower molar always, and the last upper molar generally, longer than the two preceding molars together. Mammæ 6 pairs.

Colour. Black, more or less mixed with rusty brown or whitish; young animals browner, old animals greyish. The young, when first born, are light fulvous brown, with longitudinal stripes of dark brown.

Dimensions. Adult animals measure about 5 feet from nose to vent; tail 8 to 11.5 in., with hair a foot or more; ear 5.5 in.

Height 28 to 36 inches at the shoulder ; according to Simson, one of the largest boars he ever killed (in Bengal, where some are of great size) was just under 38 inches high. Males are larger than females.

Basal length of a large boar's skull 13·75 inches, zygomatic breadth 7·3. Weight of adults from about 200 to considerably over 300 lb. (4 maunds). The lower tusks in a large hog are said to have measured 12 inches in length, including the portion imbedded in the jaw, but they rarely exceed 9.

Distribution. Throughout India, Ceylon, and Burma; on the Himalayas to a considerable elevation. Capt. Baldwin says he has seen their tracks at 15,000 feet.

Varieties. Blyth at one time divided the wild pigs of India into 3 species, distinguished by the form of the skull, and especially by the breadth and convexity of the frontal plane in the parietal region, the skull of the large Bengal type being broadest and most convex, and a Ceylonese skull narrowest. There appears, however, to be no constant distinction, although large skulls from the Gangetic plain exhibit the peculiarities noticed by Blyth. The other characters mentioned by him are not, I believe, peculiar to the Bengal race. Some years ago I called attention (J. A. S. B. xxxvi, p. 197) to the occurrence in forest and bush-jungle of whole herds of brown pigs, and to my having seen a large solitary hog of the same colour, a dull brown, quite different from the usual blackish tint. This was on the Nerbudda, south-east of Indore ; but I have seen pigs of the same colour in various parts of India, including, I think, Western Bengal. The same variation has been noticed by Forsyth.

Sus cristatus is distinguished from the European wild boar, *S. scrofa*, by its much more developed crest or mane, and by the proportionally greater size and complexity of the last molar in each jaw. The Indian pig is higher, and much more thinly covered with hair. According to Jerdon the tail is more tufted and the malar beard more marked, perhaps owing to the hair in general being less shaggy. The wild pigs of Baluchistan and Afghanistan may be *S. scrofa*, as are, I think, those of Persia and Mesopotamia.

The tame pig of India is doubtless derived from the wild animal and probably breeds with the latter in places. I have more than once seen a litter of tame young pigs striped ; and as this peculiarity is wanting in tame animals generally, such litters may have been the produce of tame sows by wild boars.

According to Blyth the Tenasserim wild pig is a much smaller form, adult skulls being one-fifth less in linear dimensions.

Habits. The Indian wild boar is found during the day in high grass or bushes, sometimes in forest and often in high crops—the females and young as a rule associating in herds or “sounders” usually of ten or a dozen, and rarely exceeding about twenty individuals, whilst the adult males keep apart. They roam about and feed on various vegetable substances in the morning and evening. They are partial to marsh, and feed largely on the roots of plants growing in swampy places—especially, according to

Jerdon, on those of a sedge that is found on the edges of tanks. They turn up the soft ground with their snouts when rooting about for food, and leave marks easily recognized. No animals are more destructive to crops. The food of wild pigs is, however, not absolutely restricted to vegetables; they have several times been observed to feed on dead animals, and Mr. Peal states that in Assam they dig out and eat the fish that bury themselves in mud during the dry season. Wild pigs feed much at night, but they are less nocturnal in tracts where they can feed without disturbance after sunrise.

The speed of a wild pig is considerable, but not for a long distance; on any practicable ground either boar or sow may be caught by a fair horse within a moderate distance. Spearing hogs, or "pigsticking" as it is commonly called in India, is unquestionably the finest sport in the country, and owes its excitement to the circumstance that, as Sterndale justly remarks, a boar is perhaps the most courageous of all wild animals, and generally fights to the death, receiving spear after spear and charging horseman after horseman with reckless gallantry. Several instances are on record of desperate fights between a large boar and a tiger, and in not a few the tiger has been killed. Sterndale mentions two cases within his own knowledge. McMaster relates an instance of a boar charging, knocking over, and ripping a camel, and occasionally even elephants are attacked. Yet a boar seldom makes an attack without provocation. There is much difference in both the endurance and courage of hogs in different parts of India, the large heavy pig of Bengal having less taste for running and more for fighting than the more lightly built animal of the Deccan or the Punjab.

Wild pigs have a habit of cutting grass and making a kind of shelter in which they are said to leave the young. Old boars may sometimes be found in these lairs, as Simson states in his 'Letters on Sport in Eastern Bengal.'

Pigs are much more prolific than most of the Ungulata. The period of gestation is about 4 months, and they, sometimes at all events, breed twice in the year; the number of young is usually 4 to 6 in *S. scrofa* and probably the same in *S. cristatus*. The European wild pigs breed in the second year and live from 20 to 25 years.

375. *Sus andamanensis*. *The Andaman Pig*.

Sus andamanensis, Blyth, *J. A. S. B.* xxvii, p. 267 (1858); xxviii, p. 271; xxix, p. 103; *id. Cat.* p. 141; *W. Sclater, Cat.* p. 195.

Tail very short. Animal covered with somewhat shaggy and long bristles; no distinct crest on the neck or back in the only skin examined. Molars much less complex than in *S. cristatus*. The hinder molar, above and below, shorter than the two preceding molars together.

Colour. Black, tips of some dorsal bristles brownish grey.

Dimensions. Height at shoulder about 20 inches; basal length of an adult male skull 9, zygomatic breadth 4·5.

Distribution. Forests of the Ardaman Islands.

376. *Sus salvanius.* The pigmy Hog.

Porcula salvania, Hodgson, *J. A. S. B.* xvi, pp. 423, 593, pls. xii, xiii; xvii, pt. 2, p. 480, pl. xxvii; Horsfield, *P. Z. S.* 1853, p. 192, pl. xxxvii; Jerdon, *Mam.* p. 244; Selater, *P. Z. S.* 1882, p. 546, pl. xxxvii; 1883, p. 388, pl. xliii, juv.; W. Selater, *Cat.* p. 195.

Sus salvanius, Garson, *P. Z. S.* 1883, p. 413.

Sano banel, Nepal.

* No distinct crest, but hair on hind neck and middle of back rather longer. Ears small, naked. Tail very short. No woolly underfur. Three pairs of mammae. The last molar, either upper or lower, is considerably shorter than the two preceding molars together.

Colour. Brown or blackish brown, black and brown bristly hairs being mixed. The young are dark brown, with longitudinal rufous bands, above and on the sides, white beneath.

Dimensions. An old male measured by Hodgson was 26 inches from snout to rump, 11·25 high at the shoulder, ear 2·75, tail 1·25. Weight 17 lb. The skull measures 5·9 in basal length, and 3·2 in zygomatic breadth.

Distribution. The forest at the base of the Himalayas in Nepal, Sikhim and Bhutan.

Habits. Apparently very similar to those of *S. cristatus*. The pigmy hog is chiefly found in high grass-jungle, and is said to live in herds of from 5 to 20, the adult boars keeping with the females. These small pigs are very rarely seen, as, like other swine, they only leave the forest at night.

The *Hippopotamidae*, now confined to Africa, were, in Pliocene and Pleistocene times, represented in India by several species, some of which probably were contemporaries of man, a worked flint having been found in the Nerbudda gravels that contain bones of *Hippopotamus*. Falconer thought that these animals might have lived until the Arian immigration, and that they might have been the *Jald-hasti*, or water-elephant, of Sanscrit writers, but it appears more probable that the animal thus named was *Platanista*.

Order CETACEA.

Whales, dolphins, and porpoises constitute an order differing widely, both in form and structure, from all land-mammals. They were at one time supposed to have some affinity with the Carnivora, but Flower has shown that the relationship is doubtful, and that Cetaceans are probably more nearly allied to some of the primitive Ungulates than to any other Mammalia.

The Cetacea are modified for a purely aquatic life and their external form much resembles that of Fishes. There are no external hind limbs, whilst the tail is flattened and expanded into lobes, known as flukes, so as to resemble that of a fish in outline, though the expansion is horizontal instead of vertical. The anterior limbs are converted into paddles, termed flippers or pectoral fins, the digits being completely united together by skin and destitute of nails. There is in most genera a dorsal fin composed of integument. The skin is smooth and hairless, with the exception of a few bristles round the mouth, generally confined to young animals; but the body is surrounded, immediately beneath the skin, by a thick layer of fat or "blubber," which, like the hair or wool of land-animals, serves to retain the heat of the body.

The eye is small and the ear-orifice minute; there is no trace of an external ear. The nostrils open either separately or by a single, generally crescentic, orifice or "blow-hole" much above the extremity of the snout, and in most forms on the top of the head. The mammae, two in number, discharge each by a teat lying in a groove, one on each side of the genital orifice. The testes are abdominal, the uterus is bicornuate, the placenta non-deciduate and diffuse.

The peculiarities of the skeleton are too numerous for any except the most important to be here mentioned. The bones generally are spongy in texture, the cavities being filled with oil. The skull is greatly modified and consists of a short, almost round brain-case, and of a more or less elongate rostrum. The cervical vertebrae are often partially or wholly anchylosed. There is no sacrum. The mode of attachment of the ribs to the vertebrae is more or less peculiar, and presents modifications characteristic of the different families. There are no clavicles. The radius and ulna are distinct, and are flattened, as are all the bones of the wrist and hand. The digits are 4 or 5 in number, more often the latter, and the phalanges of the second and third digits greatly exceed in number those found in other mammals. A pair of styliform bones represent the pelvis.

In one large group no teeth occur, except in the fœtus; when teeth are present after birth, all are similar in form, and are not preceded by milk-teeth.

By far the majority of Cetaceæ are marine, but many enter large rivers, and a few are restricted to them. All are carnivorous and live on fish, crustacea, or mollusca; one genus, *Orca*, preying on seals and whales. Like other mammals, cetaceans are air-breathers and come to the surface of the water to breathe or "blow." The old idea, represented in many pictures, that whales "spout" or eject by the blow-holes water taken in by the mouth, is erroneous, the supposed jet being merely the expired air, with watery and mucous particles forming spray. The "spouting" is naturally much more conspicuous in cold regions. The acts of expiration and inspiration are very quickly performed, especially by dolphins. The order is divided into two suborders thus defined:—

No teeth after birth; baleen present. Breathing-orifice double MYSTACOCÆTI.
Teeth present throughout life; no baleen.
Breathing-orifice single ODONTOCÆTI.

In the preparation of the following account of Indian cetaceans, I have generally followed Prof. W. H. Flower, to whom I am indebted for much personal aid, in addition to the information published in his papers on various genera of the order.

Suborder MYSTACOCÆTI.

Teeth never present after birth. The palate is furnished with numerous plates of baleen or whalebone, serving to strain the water from the fish, crustacea, or mollusca, mostly of small size, on which whales feed. Skull symmetrical. Rami of mandible arched outwards, not uniting in a true symphysis at the distal extremities. Ribs very loosely connected with the vertebræ, and articulating only with their transverse processes; the first rib alone connected with the sternum. External openings of the two nostrils separate, longitudinal. A cæcum present.

Family BALÆNIDÆ.

Characters of the suborder, of which this is the only family. The principal genera are the Right Whales (*Balæna*), with enormous heads, long baleen, no dorsal fin, and united cervical vertebræ, and the Humpbacks (*Megaptera*) and Fin-whales or Rorquals (*Balænoptera*); with smaller heads, shorter baleen, a dorsal fin, and free cervicals. Only the last-named genus has been as yet clearly recorded from Indian seas.

Genus **BALÆNOPTERA**, Lacépède, 1804.Syn. *Physalus*, Cuvierius, Sibbaldius, &c., Gray.

Form slender; head flat, pointed, measuring $\frac{1}{4}$ to $\frac{1}{5}$ of the total length. Skin of the throat with deep longitudinal furrows. A small falcate dorsal fin, placed far back about two-thirds of the distance from head to tail. Pectoral limbs or flippers small, narrow and pointed, $\frac{1}{4}$ to $\frac{1}{11}$ of total length, tetradactylous. Baleen short and coarse. Cervical vertebræ free.

The members of this genus, known to whalers as Finners, Fin-whales, Fin-backs, Razor-backs, or Rorquals, are found in all seas. Formerly, when Right-whales (*Balæna*) were more common, other whales, and especially Finners and Humpbacks, were not attacked by whalers, as these whales, owing to their greater speed, are more difficult to kill, and they yield far less oil and whalebone. Of late years, however, Finners have been pursued by means of steam-vessels and attacked with improved forms of harpoon-guns, and large numbers have been captured.

Four species of the genus *Balænoptera* have long been known to whalers in the northern seas, but have only recently been clearly identified by naturalists, chiefly through the work of Profs. Flower and Van Beneden. It has been ascertained that all, unlike the Greenland whale (*Balæna mysticetus*), are migratory, and visit the seas of Norway, Iceland, and even of Greenland in summer, returning to warmer seas in winter. It has been satisfactorily shown that some of the Fin-whales of the southern hemisphere (New Zealand, &c.) are identical with those of northern seas; and in his last work ('Hist. Nat. des Cétacés des Mers d'Europe') Prof. Van Beneden has identified all species of *Balænoptera* hitherto described, including those of the Indian seas, with these four species. To facilitate the comparison of Indian whales, the following leading characters of the four are given, chiefly from Mr. R. Collett's descriptions (P. Z. S. 1886, p. 264):—

1. *Balænoptera rostrata*.—Length 25 to 30 feet, seldom exceeding 33 feet. Height of body to total length 1 : 5. Greyish black above, white below, including lower side of tail; a broad band of white across outer side of each flipper, inner side all white. Flippers $\frac{1}{4}$ total length, jaws $1\frac{1}{2}$. Vertebræ about 48, ribs 11 pairs.

2. *B. borealis*.—Length 40 to 48 feet, rarely as much as 52. Height to total length 1 : $5\frac{1}{2}$. Bluish black above, with oblong white spots



Fig. 183.—*Balænoptera borealis* (from P. Z. S. 1886, pl. xxv).

more or less white below; tail and flippers black on both sides. Flippers very small, $\frac{1}{11}$ total length, jaws $\frac{3}{4}$. Vertebræ 55 to 56, ribs 13 pairs.

• 3. *B. musculus*.—Length 60 to 65 feet, rarely exceeding 70. Very elongate. Height to total length 1: $6\frac{1}{2}$ or $6\frac{3}{4}$. Greyish slate above and on left lower jaw; below, with right lower jaw, inside of flippers, and lower side of tail-flukes, white. Flippers $\frac{2}{3}$ total length, jaws $\frac{1}{4}$. Vertebrae about 62, ribs 15 pairs.

4. *B. sibbaldi*.—Length 70 to 80 feet, rarely exceeding 85. Height to total length 1: $5\frac{1}{2}$. Dark bluish grey, with small whitish spots on breast; lower edges and inner sides of flippers white. Flippers $\frac{1}{4}$ total length, jaws $\frac{3}{8}$. Vertebrae about 63, ribs 15–16 pairs.

Curiously enough, four species have been indicated more or less distinctly in the Indian Ocean, viz.: *B. indica* by Blyth, *B. schlegeli*, from Java, by Flower, *B. blythi* and *B. edeni* by Anderson. The first is of the same size as the great *B. sibbaldi*; the second has been clearly identified by its describer with *B. borealis*; *B. blythi* corresponds in size with *B. musculus*; and the published figures representing bones of *B. edeni* are referred by Van Beneden without doubt (*op. cit.* p. 186) to *B. rostrata*. It should, however, be added that Van Beneden, in another part of the same work (p. 155), appears to refer the same *B. edeni* to *B. borealis*, and that there is no evidence as to the locality whence came the few vertebrae to which Anderson (*An. Zool. Res.* p. 564) gave the name of *B. blythi*; it is uncertain whether these bones are of Indian or even of Asiatic origin. The identifications of *B. indica* and *B. edeni* are probable, but both have been found in Indian seas in the summer, when, according to the theory of migration, they should be in colder regions; and *B. edeni*, although agreeing in most characters with *B. rostrata*, is larger. For the present, therefore, I leave the two undoubted Indian species under the names by which they were described.

The Fin-whales feed on fish and crustacea, and are found sometimes solitary, sometimes in shoals.

Synopsis of Indian Species.

Adults 80 feet or more in length *B. indica*, p. 567.
Adults about 40 feet long *B. edeni*, p. 568.

377. *Balænoptera indica*. *The great Indian Fin-whale.*

Balænoptera indica, Blyth, *J. A. S. B.* xxviii, p. 488 (1859) (*conf. op. cit.* xxi, p. 358, xxii, p. 414, xxix, p. 451); *id.* *Cat.* p. 63; *id.* *Mam. Birds Burma*, p. 34; Jerdon, *Mam.* p. 161; Anderson, *An. Zool. Res.* p. 551; Murray, *Vert. Zool. Sind*, p. 41, pl. vi (skull); W. Sclater, *Cat.* p. 313.

External characters unknown. Described from two mandibular rami, a rib, the right radius, and 5 vertebrae preserved in the Indian Museum, Calcutta. The character by which the species is especially distinguished, according to Blyth, is the slenderness of the mandible.

Dimensions. Total length of adult 80 to 90 feet. The lower jaw of a specimen said to be 84 feet long measured nearly 21 feet

in length, 18 inches in vertical diameter at a spot 3 feet in advance of the coronoid process, and nearly 27 inches at the coronoid. The radius was 39 inches long; a rib (probably the third) 8 feet 2 inches.

Distribution. Bay of Bengal and Arabian Sea. A large whale, probably this species, is not rare on the coast of Baluchistan. The animal from which the typical bones were procured was stranded on Amherst Island, Arrakan, in the rainy season of 1851. Another came ashore alive, Sept. 15, 1842, near Chittagong. Other individuals have been stranded on the coast of Sind; of one the skull, 17 feet 8 inches long, is preserved in the Karachi Museum, and this large whale has also been recorded on the coasts of Malabar and Ceylon.

As already pointed out, this species is probably the same as the great northern Fin-whale (*B. sibbaldi*). It is the largest of all known animals, living or extinct.

378. *Balænoptera edeni*. *The smaller Indian Fin-whale.*

Balænoptera edeni, Anderson, *An. Zool. Res.* p. 551, pl. xliv (skull and vertebræ); *W. Slater, Cat.* p. 314.

Of this whale, also, no details of the external characters are known, but a skull, the vertebræ, and some other bones of an adolescent individual are preserved in the Indian Museum, Calcutta. The vertebral formula is believed to be C. 7, D. 10, L. 14, C. 21, = 52. The skull is very long, the maxillary portion especially.

Dimensions. Total length of adult probably 40 feet. In an adolescent individual 37 feet long the skull was 9 feet 11 inches long, 4 feet 5 inches broad (a larger skull 10 feet 4 inches by 4 feet 10 inches), lower jaw 9 feet 5 inches; humerus 12.25 inches, radius 22; height of mandible at coronoid process 14, length of baleen about 12. Additional measurements of various bones are given by Anderson.

Distribution. Bay of Bengal. The type was stranded in the Sittoung Estuary, June 18, 1871.

As already pointed out, this whale is referred by Van Beneden to *B. rostrata*.

Although no specimen has yet been procured from the Indian seas, there can be little if any doubt that a species of *Megaptera* exists there. In this genus the head is of moderate size, the body much less slender than in *Balænoptera*, and there is a protuberance or hump forming the base of a low dorsal fin. Throat plicated; baleen-plates short and broad; cervical vertebræ free. The pectoral limb is very long and narrow, being one-fourth the total length of the animal. This whale grows to a length of 50 or 60 feet or even more.

The common Atlantic form, *M. boops*, is said to occur in almost all seas; but another species, *M. indica* (Gervais, *Comptes Rendus*, xcvii, p. 1566), has been described from the Persian

Gulf, and Van Beneden is inclined to regard this form as distinct. A skull of *M. boops* from Java is, however, in the Leyden Museum. A whale some years since (July 1873) was entangled in the telegraph-cable off the Baluchistan coast and drowned. The tail was covered with barnacles (Cirripeds), and this, as Van Beneden points out, is characteristic of *Megaptera*. I myself once saw a whale of much stouter form than *Balænoptera*, under favourable circumstances, a great part of the body being above the sea at times, off the mouth of the Indus. Gray (Cat. Seals and Whales



Fig. 184.—Humpbacked Whale, *Megaptera boops*. (Flower, art. "Whale," 'Encyclopædia Britannica.')

B. M. 1866, p. 131) refers an imperfect skeleton in the Asiatic Society's collection at Calcutta to this genus, but on evidence that is scarcely convincing.

The accompanying figure of *M. boops* may assist in the recognition of the genus.

Suborder ODONTOCETI.

Teeth always present in one or both jaws after birth. No baleen. Upper surface of skull asymmetrical. Ramus of mandible nearly straight, meeting distally in a true symphysis. Several of the anterior ribs articulate with the bodies of the vertebrae, and several pairs are connected with the sternum by sternal ribs. Manus always pentadactylous. Nostrils united into a single external orifice. No cæcum, except in *Platanista*.

Three families compose this suborder; all are found in Indian seas or rivers. They are distinguished as follows:—

- | | |
|--|----------------------|
| A. Functional teeth in the lower jaw only..... | Physeteridæ. |
| B. Functional teeth in both jaws (upper teeth deciduous in <i>Grampus</i>). | |
| a. Ribs abnormally articulated. Symphysis of mandible never exceeding $\frac{1}{3}$ length of ramus..... | Delphinidæ. |
| b. Ribs normally articulated. Mandibular symphysis $\frac{1}{2}$ length of ramus | Platanistidæ. |

Family PHYSETERIDÆ.

No functional teeth in the upper jaw. Teeth in lower jaw varying in number, sometimes only one or two on each side. Bones of cranium rising into a crest behind the nares. Pterygoid bones thick, produced backwards, and not involuted to form the outer wall of the post-palatal air-sinuses. Transverse processes of the arches of the dorsal vertebræ, to which the tubercles of the ribs are attached, ceasing abruptly near the posterior end of the series, and replaced by other processes at a lower level from the bodies of the vertebræ, the latter processes homologous anteriorly with the heads of the ribs, and posteriorly with the transverse processes of the lumbar vertebræ. (In *Physeter* both processes are found in the same vertebra in the region of transition.)

All the members of this family are oceanic, and all, so far as is known, subsist mainly on Cephalopoda (cuttle-fishes). Besides the sperm-whales, which form the subfamily *Physeterina*, and have, in each mandibular ramus, several teeth set, not in distinct alveoli, but in a long groove imperfectly divided by partial septa, the present family contains the ziphioid whales, or subfamily *Ziphiina*, in which only one or two teeth are functionally developed in each ramus of the mandible. Members of the first subfamily alone are known from the Indian seas, though there can be little if any doubt that some representatives of the *Ziphiina*, several of which inhabit the Indian Ocean, occur near the coasts of British India.

Only two genera of sperm-whales are known; both are Indian, and they are easily distinguished thus:—

| | |
|---|-----------|
| Head very large; lower teeth 20 to 25 on each side..... | PHYSETER. |
| Head moderate; lower teeth 9 to 13 on each side..... | COGIA. |

Genus PHYSETER, Linn. (1766).

Syn. *Catodon*, Artedi.

Teeth of the upper jaw rudimentary, simply imbedded in the gum. Lower teeth 20-25 on each side, stout, conical, recurved, pointed until worn, and without enamel. Upper surface of the skull formed of a high semicircular crest, with a deep hollow in front; from the bottom of this hollow the elongate rostrum protrudes. Lower jaw very long, the symphysis half as long as the jaw itself.

Vertebræ: C. 7, D. 11, L. 8, C. 24. Atlas free, the other cervicals united.

Head about one third the length of the body ($\frac{1}{4}$ total length), high, subcylindrical, ending abruptly in front, as if truncated. Blowhole single, longitudinal, and at the left side of the upper anterior extremity of the huge muzzle. The mouth opens beneath the muzzle, and some distance short of the end. Pectoral limbs

short, broad, and truncated. Dorsal fin replaced by a low protuberance.

The upper part of the huge head is filled with the substance known as spermaceti. The same substance is found, though in smaller quantities, in other *Physeteridæ*, probably in all.

Only one species is known with certainty.

379. *Physeter macrocephalus*. The Sperm-whale or Cachalot.

Physeter macrocephalus, *L. Syst. Nat.* i, p. 107 (1766); *W. Sclater, Cat.* p. 314.

Catodon macrocephalus, *Blyth, Cat.* p. 93.

Colour black or blackish throughout, or whitish below.

Dimensions. Males grow to about 60 feet; females are said not to attain more than half that length.

Distribution. Pelagic; found in nearly all tropical and sub-tropical seas, occasionally visiting colder regions. Formerly this whale is said to have been much hunted in the Bay of Bengal and off Ceylon. The only recorded case of an individual being stranded on the Indian coast, so far as I am aware, took place in January 1890 at Madras, and was noticed by Mr. Thurston, Superintendent, Government Central Museum. The animal was about 24 feet long.



Fig. 185.-- Sperm-whale (*Physeter macrocephalus*). (Flower, Art. "Whale," 'Encyclopædia Britannica'.)

Habits. The Sperm-whale is found in the open sea, generally in herds or "schools" varying from ten or fifteen to a very large number, sometimes, it is said, as many as two hundred animals. The old males live apart. All wander much, sperm-whales having been killed in the Atlantic with harpoons that had been left in them in the Pacific Ocean. These animals can dive for a long time and to great depths. Their movements are more rapid than those of other whales.

The Cachalot, like other *Physeteridæ*, appears to feed entirely on Cephalopoda (cuttle-fishes). Besides the spermaceti from the head and sperm-oil from the blubber, this whale yields ambergris, which is a concretion formed in the intestine and found sometimes floating on the sea.

Genus **COGIA**, Gray, 1846.

Syn. *Kogia*, auct.; *Euphysetes*, MacLeay (1851).

Upper teeth absent, or represented by a rudimentary anterior pair embedded in the gum; 9 to 13 lower teeth on each side, long, slender, pointed, curved backwards, and coated with enamel. Upper surface of cranium slightly concave, rostrum not longer than cranial portion of skull. Mandibular symphysis less than half the entire length of the rami.

Vertebrae: C. 7, D. 13-14, L. & C. 30. All cervical vertebrae united.

External form not unlike that of a porpoise. Head about one sixth of the total length, obtusely pointed in front. Mouth small, inferior, and considerably short of the end of the snout. Blowhole crescentic, on top of head, but to the left of the median line and anterior to the eyes. Pectoral fins obtusely falcate. A well-developed dorsal fin.

Several nominal species have been described, but all are probably varieties of one.

380. *Cogia breviceps*, *The small Sperm-whale*.

Physeter breviceps, Blainv. *Ann. Anat. Phys.* ii, p. 337 (1838).

Kogia breviceps, Gray, *Zool. Erebus & Terror*, p. 22 (1846).

Euphysetes grayii, Wall, *Hist. New Sperm Whale*, Sydney, p. 37 (1851).

Euphysetes macleayi, Krefft, *P. Z. S.* 1865, p. 708, figs.

Physeter (Euphysetes) simus, Owen, *Tr. Z. S.* vi, p. 30, pls. x-xiv (1866); Elliot, *ib.* p. 171.

Wongu, Telugu.

Colour. Above shining black, growing paler below.

Dimensions. An immature female, captured at Vizagapatam, was

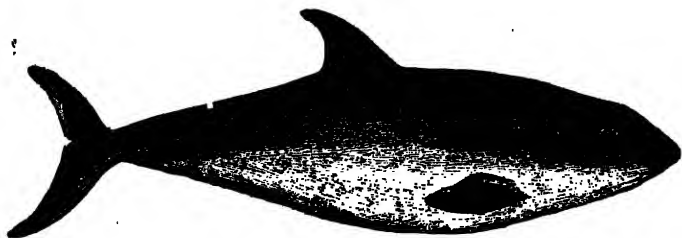


Fig. 186.—*Cogia breviceps*. (From Elliot's figure.)

7 ft. 2 in. long, from muzzle to dorsal fin 3 ft. 4 in., snout to pectoral limb 17 inches, length of pectoral 14, breadth of tail-flukes 22. The dorsal fin was 11 inches high and 1 foot long, the girth in front of the dorsal 4 ft. 4 in. (Elliot, *Tr. Z. S.* vi, p. 172). The

dimensions given by Owen were incorrect. Australian individuals have been measured exceeding 10 feet in length.

Distribution. Indian and Australian seas; Cape of Good Hope; North Pacific. Probably widely distributed. Habits quite unknown. The specimen obtained at Vizagapatam by Sir W. Elliot was the type of *P. simus*, Owen.

It has already been pointed out, that some members of the *Ziphiina* are in all probability found in the Indian seas. They are small whales, generally from 10 to 25 feet long, the best known being the "Bottle-nose" (*Hyperoodon rostratus*) of the North Atlantic. Amongst the forms probably inhabiting the seas around India are *Ziphius cavirostris*, with a single tooth near the anterior end of each mandibular ramus; and *Mesoplodon densirostris* (*Diplodon sechellensis*, Gray), with a large tooth on each side in the middle of the lower jaw.

Family DELPHINIDÆ.

The present family comprises all porpoises and true dolphins*, with the exception of a few fluviatile types. The species are much more numerous than those of any other family of Cetacea.

The size in general is moderate or small. The teeth (except in the genus *Grampus*) are numerous in both jaws. The pterygoid bones are short, thin, each involuted to form, with a process of the palate-bone, the outer wall of the post-palatine air-sinus. Symphysis never much exceeding one third of the mandible in length and generally much shorter. Transverse processes of the dorsal vertebræ gradually transferred from the arches to the bodies of the vertebræ without any sudden break; each anterior rib attached to the transverse process by the tubercle and to the body of the vertebra by the head, the latter attachment lost in the posterior ribs. Sternal ribs firmly ossified. Cervical vertebræ varying, the first two to four generally united.

The genera of this family tend to pass into each other, and with a few exceptions are very difficult to distinguish. Professor Flower (P. Z. S. 1883, p. 466) has, however, reduced the numerous genera of Gray into order; and recently, in 1889, Mr. F. W. True has published a review of the family *Delphinidæ* (Bulletin no. 36 of the United States National Museum, Washington), and has done much towards distinguishing the various species and eliminating unnecessary synonyms. The following descriptions are in great measure taken from the two works just quoted.

Our knowledge of the Indian porpoises and dolphins is still extremely imperfect. For the little we know, we are chiefly

* The Dolphin of sailors, celebrated for the changes of colour it undergoes when dying, is a fish (*Coryphæna hippurus*).

indebted to Blyth*, Elliot, and Anderson. In all probability several species have still to be recognized, whilst of some of those known only single occurrences have hitherto been recorded. Skins are difficult to preserve, and of no great use in identification; a good sketch to scale and a skeleton are better.

Synopsis of Indian Genera.

- | | |
|--|-----------------|
| A. Teeth small, spade-like, with flat crowns | PHOCÆNA. |
| B. Teeth very large, an inch in diameter or more. | ORCA. |
| C. Teeth moderate or small, conical. | |
| a. Head globose, no trace of a beak. | |
| a'. Teeth confined to anterior half of rostrum. | GLORICEPHALUS. |
| b'. Teeth occupying greater part of rostrum . . | ORCELLA. |
| b. Head with a short, not very distinct beak . . | LAGENORHYNCHUS. |
| c. Head with a distinct compressed beak. | |
| a'. Teeth not less than $\frac{1}{2}$ inch in diameter, and round in section. | |
| a''. Symphysis much shorter than $\frac{1}{2}$ man- dible | TURSIOPS. |
| b''. Symphysis longer than $\frac{1}{2}$ mandible. . . . | STENO. |
| b'. Teeth less than $\frac{1}{2}$ inch in diameter, oval in section, and exceeding 35 on each side of each jaw | DELPHINUS. |

Genus PHOCÆNA, Cuvier (1817).

Syn. *Neomeris*, Gray (1846) (*nec* Lamouroux).

Size small. Head without a beak, snout rounded. Dorsal fin variable, wanting in the only Indian species.

Teeth 16 to 26 on each side of each jaw, small, spade-shaped, the crown being much broader than the root, and compressed in the direction of the jaw, the upper border either entire or divided into two or three lobes. Rostrum short and broad, palate very broad. Pterygoid bones small, widely separated. Mandibular symphysis short. Vertebrae 57 to 67.

This genus, the type of which is the common porpoise of the British Islands, is widely distributed on sea-coasts and in estuaries. One species is found in India.

Delphinapterus phocænoides, Cuv. *Règne An.* éd. 2, i, p. 291 (1829).
Neomeris phocænoides, Gray, *Zool. Ereth. & Terror*, p. 30 (1846);
Blyth, J. A. S. B. xxix, p. 449; *id. Cat.* p. 89; *Flower, P. Z. S.*
 1883, p. 506; *True, Delphinidæ*, pp. 114, 178, pl. xxxiv, figs. 1, 2;
W. Sclater, Cat. p. 318.

* I am indebted to Mr. W. L. Sclater, who has kindly made notes and measurements of the specimens preserved in the Calcutta Museum, for much assistance in identifying the species mentioned by Blyth.

- *Delphinus melas*, *Temm. Faun. Jap., Mam. Mar.* p. 14, pls. xxv, xxvi, 1847 (*nec Traill*, 1809).
- Delphinapterus molagan*, *Owen, Tr. Z. S.* vi, p. 24 (1866).
- Neomeris kurrachiensis*, *Murray, A. M. N. H.* (5) xiii, p. 351 (1884); *id. Jour. Bombay N. H. Soc.* i, p. 159, plate.
- Molagan*, *Tamul* (Elliot); *Bhulga*, *Mahr.* (Sinclair).

Snout rounded; head very convex. No dorsal fin; pectorals sub-ovate. A band of tubercles on the back, broad in front, narrow behind, from above the insertion of the pectorals to above the vent. Teeth about $\frac{18}{18}$ (18 on each side of each jaw). Vertebræ; C. 7, D. 12-13, L. & C. 38-43.

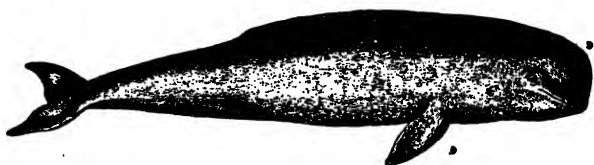


Fig. 187.—*Phocæna phocænoides*. (From a drawing by R. A. Sterndale.)

Colour. Black throughout; a purplish-red patch on the upper lip and one on the throat were observed by Murray.

Dimensions. Length 45 inches, snout to pectoral fin 10, expanse of tail 9 (*Murray*). A Bombay female was 50 inches long, 31 in girth, with a tail 15 wide and pectoral fin 9 long; weight 60 lbs. Basal length of skull 7.75, length of rostrum 3, breadth of skull between orbits 4.75.

Distribution. The shores of the Indian Ocean, from the Cape of Good Hope to Japan. Recorded in India from tidal rivers near Calcutta; also from Madras, Malabar, Bombay, and Karachi.

Habits. For the following details I am indebted to Professor Flower, to whom they were sent by Mr. W. F. Sinclair of Bombay. This porpoise "frequents the tidal creeks, not ascending very far, and the sounds among the reefs and islands. It feeds chiefly on prawns, also on small cephalopods and fish. It does not appear to herd in 'schools'; more than four or five are rarely, if ever, seen together. Usually it is solitary; the pairs seem to consist of female and calf, more often than male and female. The young (one in number) are born, apparently, about October. The roll of this porpoise is like that of *Phocæna communis*. It does not jump or turn summersaults like *Platanista* and the *Delphini*, and is, on the whole, a sluggish little porpoise."

According to Mr. Sinclair's observations, this species is only found in shallow water.

This porpoise has generally been placed in the genus *Neomeris*, distinguished from *Phocæna* by wanting a dorsal fin. As there is no other distinction, and the species are in other respects nearly allied, it appears unnecessary to maintain the generic distinction.

Genus **ORCA**, Wagler (1830).

Size very large. No beak; head conical and depressed. Dorsal fin erect, very high, especially in the male. Pectoral fins large, broadly ovate.

Teeth few, 10 to 13 on each side above and below, very large, often an inch or more in diameter, oval in section, the longer diameter across the jaw. Rostrum broad. Pterygoids separate. Vertebrae: C. 7, D. 11-12, L. 9-10, C. 24=51 or 52.

The animals of this genus are highly predatory, living on seals, whales, and other cetaceans, besides fish. They associate in small herds, and are said to attack and kill even the largest whales. Many species have been described, but it is quite uncertain how far they can be distinguished.

382. *Orca*, sp. (*O. gladiator*?—*The Grampus or Killer*).

? *Delphinus orca*, *L. Syst. Nat.* i, p. 108 (1766).

? *Delphinus gladiator*, *Bonnaterre, Cét.* p. 22 (1789).

? *Orca gladiator*, *Gray, Zool. Erch. & Terror*, p. 33; *Flower, P. Z. S.* 1883, p. 507; *True, Delphinidæ*, p. 187, pl. xlv, figs. 1, 2.

Cetacean, *Holdsworth, P. Z. S.* 1872, p. 583 (figs. p. 584).

A cetacean was seen by Mr. E. W. H. Holdsworth in April 1868 off the west coast of Ceylon, and briefly described by him, the description being illustrated by sketches. The animal appeared to be about 25 feet long, and was furnished with a remarkable straight, erect, narrow dorsal fin about 5 feet high. As figured the fin appears scarcely a foot broad, with the anterior and posterior margins nearly parallel.

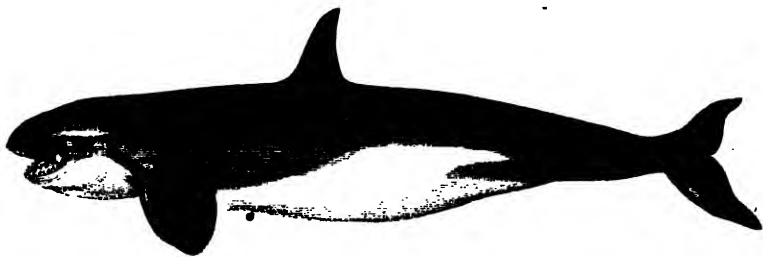


Fig. 188.—Grampus or Killer, *Orca gladiator*. (Flower, art. "Mammalia," *Encyclopædia Britannica*.)

The only cetacean with a fin of this kind is *Orca*, but generally the dorsal fin, though very high, especially in the male, is represented as triangular. There is a skull of *O. gladiator* from the Seychelle Islands in the British Museum, so this species is an inhabitant of the Indian Ocean. *O. gladiator* grows to about 20 feet in length, the teeth are 10-13 in number on each side above and below, and the coloration is peculiar—the upper parts generally, with the fins, black; the lower to the vent white, but the white

forms a trident posteriorly and there are white patches on each side of the head. The accompanying figure may enable the species, if seen in Indian seas, to be recognized.

Genus **GLOBICEPHALUS**, Lesson (1842).

Head globular, no beak. Dorsal fin long, low and thick. Pectoral fins narrow and long.

Teeth few and confined to the anterior half of the rostrum and to the corresponding part of the mandible. Skull broad and depressed, rostrum broad and flat; premaxillæ very broad, nearly or quite covering the maxillæ anteriorly. Symphysis of mandible short. Pterygoids large, prominently keeled and in contact. Vertebrae: C. 7, D. 11, L. 12-14, C. 26-29=56-59.

The members of this genus, known as 'Ca'ing Whales,' 'Pilot Whales,' and 'Blackfish,' are found in all seas and grow to a considerable size.

383. *Globicephalus indicus*. *The Indian Pilot Whale*.

Globicephalus indicus, Blyth, *J. A. S. B.* xxi, p. 358, xxviii, p. 490; *id.* *Cat.* p. 89; Jerdon, *Mam.* p. 160; True, *Delphinidæ*, p. 137; W. Selater, *Cat.* p. 319.

Nearly allied to *G. melas* of the European seas, but the colour is different, there are fewer and stouter teeth, 6-7 above and 7-8 below on each side, and the premaxillaries are much broader and completely cover the maxillaries in the rostrum. Vertebrae: C. 7, D. 11, L. 12, C. 26=56.

Colour uniform leaden black, slightly paler beneath.

Dimensions of an adult male:—Length 14 ft. 2 in., pectoral fin 24 inches long and 6 broad, dorsal fin 27 long and 11 high, expanse of tail 3 ft. Total length of a skull 65 inches, length of rostrum 33, breadth of skull between orbits 47, breadth of beak at the middle of its length 25, breadth of premaxillæ at same place 22.

Distribution. This large porpoise has hitherto only been observed on one occasion in the salt or brackish water of the Gangetic delta.

Habits. The typical examples, two in number, were from a shoal that were found stranded by Blyth on the shallows of Salt-water Lake, near Calcutta, in July 1852. The shoal was said to have consisted originally of several dozens. The animals when observed were floundering about in the shallow water and groaning painfully. Other specimens, which Mr. Blyth regarded as the young of this cetacean, have been shown by Dr. J. Anderson (*An. Zool. Res.* p. 369) to be *Orcella brevirostris*.

A genus somewhat allied to *Globicephalus*, and resembling it in external form, is *Grampus*, a pelagic type, of which a representative is very likely to be found in Indian seas. There are no teeth in

the upper jaw in adults, and 2 to 7 on each side of the lower jaw near the symphysis. The common species, *G. griseus*, which has a very wide range, is about 10 feet long, and grey in colour, the back and fins black and belly white; the sides with numerous irregular pale streaks.

Genus **ORCELLA**, Gray (1866).

Head globose, no beak. Dorsal fin small, falcate. Pectoral fins of moderate size, broad at the base, subovate.

Teeth 13 to 17 on each side of the upper jaw, 12-15 in the lower; small, conical, pointed, closely set, occupying nearly the whole length of the rostrum, the posterior teeth disappearing with age. Generally (perhaps in all adults) the anterior teeth in both jaws are directed outwards, becoming at the anterior extremity of each jaw almost horizontal. Rostrum short, tapering, broad at the base; premaxillaries broad. Pterygoids widely separated from each other, and very bluntly keeled. Mandibular symphysis short. Vertebrae: C. 7, D. 12-13, L. 14-15, C. 29-30 = 62-63.

Two species have been described, one marine, the other fluviatile, both Indian or Burmese. A full account of the anatomy of both is given by Anderson in his 'Anatomical and Zoological Researches.'

Synopsis of Indian and Burmese Species.

Colour blackish, without streaks..... *O. brevirostris*, p. 578.
 Colour pale slaty, with streaks..... *O. fluminalis*, p. 579.

384. *Orcella brevirostris*. *The larger Indian Porpoise.*

Phocaena (*Orca*) *brevirostris*, Owen, *Tr. Z. S.* vi, p. 24, pl. ix, figs. 1, 2, 3 (1866).

Orcella brevirostris, Anderson, *P. Z. S.* 1871, p. 143, fig. 1; *id. An. Zool. Res.* p. 369, pl. xxv, figs. 4, 5, pl. xliii, figs. 6-10; True, *Delphinidæ*, p. 182, pl. xxxviii, figs. 1, 2; W. Sclater, *Cat.* p. 318.

Lomba-lomba, Malay.

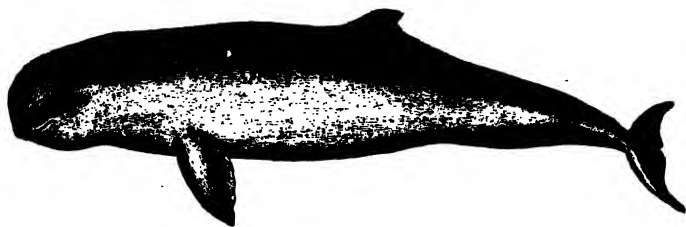


Fig. 189.—*Orcella brevirostris*. (From Anderson's figure.)

Anterior profile of head very convex. Dorsal fin commencing about middle of length, small, falcate, obtusely pointed. Pectoral fins subtriangular, pointed. Teeth about $\frac{1}{2}$.

• *Colour.* Dark slaty blue, nearly black, above, and but little paler below.

Dimensions. Total length about 7 feet. Snout to dorsal fin 46 inches, height of dorsal 3·75, snout to pectoral 16·5, anterior margin of pectoral 17, breadth of pectoral 6·20, expanse of caudal fin 21·5. A skull measures 10·6 in basal length, 7·4 broad across orbits, length of rostrum 5·1.

Distribution. Bay of Bengal, ascending rivers as far as the tide extends; also found at Singapore and in North Borneo.

385. *Orcella fluminalis.* *The Irrawaddy Porpoise.*

Orcella fluminalis, *Anderson*, *P. Z. S.* 1871, p. 143, fig. 2; *id.* *An. Zool. Res.* p. 358, pls. xxv & xxvii, &c.; *Blyth*, *Mam. Birds Burma*, p. 34; *True*, *Delphinidæ*, p. 182; *W. Sclater*, *Cat.* p. 319.

Form very similar to that of *O. brevirostris*. The dorsal fin is situated somewhat farther back, and is smaller, lower, and less falcate, and the pectorals are rather shorter and broader. The head is less globose. Teeth about $\frac{15}{14}$.

Colour. Pale slaty above, whitish below, numerous narrow streaks irregularly dispersed on the sides.

Dimensions. Length of a male $7\frac{1}{2}$ feet, snout to dorsal fin 55 inches, to pectoral 17, length of pectoral along anterior margin 17. Basal length of a skull 10·3 inches, breadth between orbits 7, length of rostrum 4·6. In another male 86 inches long, the dorsal fin was a little over 2 high.

Distribution. The deeper channels of the Irrawaddy from below Prome to above Bhámo. This porpoise has not been observed in the tidal waters of the river delta.

Habits. The Irrawaddy porpoise is gregarious, solitary individuals being rare, and it keeps to deep water, rising to breathe every minute or two as a rule, and emitting "the short blowing sound, which ends in the more feeble one of inspiration" (*Anderson*). The food, so far as known, is exclusively fish.

Mr. Thomas has recently united this species with *O. brevirostris*, but the absence of that form in other Indian rivers renders it probable that *O. fluminalis* is really distinct.

Genus **LAGENORHYNCHUS**, Gray (1846).

Head with a short, not very distinct beak, or pointed, without a beak. Dorsal and pectoral fins moderate. Caudal ridges very prominent.

Teeth variable in size. Rostrum flat, not greatly exceeding the remainder of the skull in length. Premaxillæ flat or slightly convex above. Pterygoids usually in contact. Mandibular symphysis short. Vertebrae very numerous, 73 to 92 (generally over 80).

Several species are known; of these two have been obtained in India.

Synopsis of Indian Species.

| | |
|--|------------------------------|
| Teeth about $\frac{22}{23}$; breadth of skull more than half its length | <i>L. electra</i> , p. 580. |
| Teeth about $\frac{30}{30}$; breadth of skull less than half its length | <i>L. obscurum</i> , p. 580. |

386. *Lagenorhynchus electra*. The Indian broad-beaked Dolphin.

Lagenorhynchus electra, Gray, *Zool. Ereb. & Terror*, p. 35, pl. xiii (1846); Flower, *P. Z. S.* 1883, p. 490; True, *Delphinidæ*, pp. 100, 173, pl. xxviii, figs. 1, 2; W. Sclater, *Cat.* p. 321.

Delphinus (*Lagenorhynchus*) *fusiformis*, Owen, *Tr. Z. S.* vi, p. 22, pl. v, fig. 1, pl. vii.

A short and broad beak. Dorsal and pectoral fins falcate. Snout broad. Teeth about $\frac{22}{23}$, conical, curved inwards, about $\frac{1}{8}$ inch in diameter, confined to the anterior two thirds of the rostrum and less than half the mandible. Rami of mandible deep in the posterior half and slender in front.

Colour. Dark above, darkest on the dorsal fin, the fore part of the pectoral and caudal fin, and the snout; ashy grey unspotted below (Owen). But a specimen of the same species from the Pacific is described as blue-black, with a white spot in front of each pectoral fin, a frontal band of light slate-colour, vent and abdomen reddish white.

Dimensions. An adult female measured 6 feet long, snout to pectoral fin $19\frac{1}{2}$ inches, to dorsal 31, length of pectoral fin along front margin 12, of dorsal 10. Basal length of skull 17, breadth across orbits 9.5, length of rostrum 9.75, breadth of same at base 5.4.

Distribution. Indian and Tropical Pacific Oceans. Obtained at Vizagapatam by Sir W. Elliot.

387. *Lagenorhynchus obscurum*. The beakless Dolphin.

Delphinus obscurus, Gray, *Spic. Zool.* p. 2 (1828); *id.* *Zool. Ereb. & Terror*, p. 37, pl. xvi; Blyth, *Cat.* p. 90.

Lagenorhynchus obscurus, True, *Delphinidæ*, pp. 104, 174, pl. xxix, figs. 1, 2.

Prodelphinus obscurus, Flower, *List Cetacea B. M.* p. 28 (1885); W. Sclater, *Cat.* p. 324.

No distinct beak, the head sloping gradually down to the upper lip. Fins falcate. Teeth about $\frac{30}{30}$, small, less than $\frac{1}{8}$ inch in diameter, curved inwards, those in the upper jaw occupying about $\frac{7}{8}$ of the rostrum. Skull and rostrum much narrower than in *L. electra*, and intermediate in form between those of that species and those of *Delphinus*.

Colour. Black, neck and belly white, a black band from the angle of the mouth to the pectoral fins; lateral oblique streaks of white (Gray).

Dimensions. Length (of type skin) 65 inches, length of pectoral fin 11; of a skull 14, breadth across orbits 6·7, length of rostrum 8, breadth of same at base 3·75.

Distribution. Indian and Pacific Oceans. A skull from Palk Straits, Ceylon, is in the Museum, Calcutta.

Genus **TURSIOPS**, Gervais (1855).

General form stout. Beak moderate, tapering, separated by a groove from the forehead; dorsal and pectoral fins falcate.

Skull and rostrum much broader than those of *Steno* or *Delphinus*. Rostrum moderately long, very convex above, tapering. Pterygoids in contact. Mandibular symphysis short. Teeth stout (about $\frac{1}{4}$ inch in diameter), occupying nearly the whole jaw. Vertebrae in *T. tursio*: C. 7, D. 13, L. 17, C. 27=64.

It is probable that two species of *Tursiops* occur around India, but only one has hitherto been recognized.

388. **Tursiops tursio.** *The common bottle-nose Porpoise.*

Delphinus tursio, Fabricius, *Fauna Græland.* p. 49 (1780); Flower, *Tr. Z. S.* xi, p. 3, pl. i.

Delphinus eurynome, Gray, *Zool. Erebus, & Terror*, p. 38, pl. xvii (1846); Blyth, *Cat.* p. 90.

Tursiops tursio, Flower, *P. Z. S.* 1883, p. 478; True, *Delphinidæ*, pp. 32, 158, pl. viii, figs. 1, 2; W. Schater, *Cat.* p. 323.

Teeth about $\frac{22}{23}$. Rostrum broad, depressed, forming more than half the length of the skull, its breadth in the middle $\frac{1}{3}$ to $\frac{1}{4}$ its length.

Colour of Eastern animals not known. Atlantic specimens are clear plumbeous grey, more or less tinged with purple, above, including the dorsal, pectoral, and caudal fins, and passing gradually into pure white on the belly. The limits of the two colours vary. Some individuals are black above, pale grey below, some all grey.

Dimensions. Total length of an adult male 9 ft. 6 in., snout to dorsal fin 50 inches, length of pectoral fin 15·5, vertical height of dorsal 9, breadth of flukes 24. Some individuals exceed 10 ft. in length. Skull 22 inches long, 11 broad between orbits, rostrum 12·5 long.

Distribution. Probably throughout temperate and tropical seas. Blyth records a skull of an animal captured in the Bay of Bengal. In the British Museum are specimens from Muscat and the Seychelle Islands.

It is highly probable that either *Tursiops całalanía* described from N.W. Australia, or the closely allied *T. abusalam*, inhabiting the Red Sea, is also found in the neighbourhood of India. The

two may be identical. Both are smaller than *T. tursio* and have dark spots on the lower surface. The skull of *T. catalania* is 16·75 inches long by 7·5 broad between the orbits, rostrum 9·75 long. *Delphinus* (*Steno*?) *maculiventer* (p. 585) of Owen may be *Tursiops catalania*.

Genus **STENO**, Gray (1846).

Head prolonged into a distinct narrow snout, which is separated by a groove from the forehead. Dorsal and pectoral fins falcate.

Rostrum of skull long, narrow and compressed. Symphysis of mandible long, one fourth to one third the length of the ramus. Teeth of moderate size, about one fifth (4–6 millim.) of an inch in diameter; 20 to 35 on each side of each jaw. Vertebrae of *S. frontatus*: C. 7, D. 12, L. 15, C. 32=66.

The species found on the coast of India are in part referred to *Sotalia* by Flower and True; but the differences between the Indian types here brought together appear to me scarcely to justify generic distinction, until the skeletons are known. The typical *Sotalia* are estuarine or fluviatile dolphins with 51 to 55 vertebrae.

Synopsis of Indian Species.

- A. Teeth very rugose, $\frac{20}{20}$ to $\frac{25}{27}$ *S. frontatus*, p. 582.
 B. Teeth nearly smooth.
 a. Rostrum more than $\frac{1}{3}$ length of skull;
 teeth about $\frac{37}{34}$ *S. plumbeus*, p. 583.
 b. Rostrum less than $\frac{1}{3}$ of skull.
 a'. Dark grey above; teeth about $\frac{26}{26}$ *S. perniger*, p. 583.
 b'. Speckled throughout; teeth about $\frac{34}{35}$ *S. lentiginosus*, p. 584.
 c'. Black above; teeth $\frac{27}{30}$ *S. P. maculiventer*, p. 585.

389. *Steno frontatus*. *The rough-toothed Dolphin.*

Delphinus rostratus, Shaw, *apud* Cuv. *Ann. Mus.* xix, p. 10 (1812);
Desmarest, Nouv. Dict. II. N. ix, p. 160, *nec* Shaw.

Delphinus frontatus, Cuv. *Oss. Foss.* éd. 2, v, pp. 278, 400, partim (1823).

Delphinorhynchus rostratus, Blyth, *J. A. S. B.* xv, p. 368.

Steno rostratus, Blyth, *J. A. S. B.* xxviii, p. 491; Flower, *P. Z. S.* 1883, p. 483; True, *Delphinidæ*, pp. 24, 157, pl. vi, figs. 1, 2;
W. Slater, Cat. p. 324.

Steno frontatus, Blyth, *Cat.* p. 91.

Snout long. Teeth $\frac{20}{20}$ to $\frac{25}{27}$, distinctly rugose, the enamel closely pitted with irregular very wavy furrows. Rostrum long and compressed, its breadth in the middle varying from $\frac{1}{3}$ to more than

$\frac{1}{2}$ of its length. Pterygoids in contact along the median line. Mandible with its inferior border very convex at the symphysis, which is very long, fully $\frac{1}{3}$ the ramus.

Colour. In an Atlantic specimen the upper parts and fins were purplish sooty black; sides marked with rather large stellate white spots. Snout and under surface of body white, more or less tinged with purple and rose-colour and marked with prominent purple spots (*Lütken*). The colour of Eastern specimens has not been recorded, and there may be much variation.

Dimensions. Total length 8 ft. 6 in.; snout to dorsal fin 44 inches, to pectoral 25. Length of a large skull 19.5, of rostrum 11.5; breadth of skull between orbits 7, greatest breadth 8.5.

Distribution. Indian and Atlantic Oceans. Found in the Bay of Bengal; a specimen having been captured near the Nicobar Islands.

390. *Steno plumbeus.* *The plumbeous Dolphin.*

Delphinus plumbeus, *Dussumier*, *Cuv. Règne An.* 6d. 2, i, p. 283 (1829); *Pucheran*, *Rev. Mag. Zool.* (2) viii, 1856, pp. 146, 315, 362, 449; *Jerdon*, *Mam.* p. 157.

Sotalia plumbea, *Flower*, *P. Z. S.* 1883, pp. 489, 513; *True*, *Delphinidæ*, pp. 21, 153, pl. i, figs. 1, 2; *W. Sclater*, *Cat.* p. 325.

La-maing, Burmese.

Snout very long; dorsal fin long and but little elevated; pectoral limbs short, about $\frac{1}{4}$ total length; caudal ridges prominent.

Teeth about $\frac{37}{34}$ (37 on each side of upper jaw, 34 on each side of lower). Rostrum more than $\frac{3}{8}$ length of skull; its breadth at the middle $\frac{1}{6}$ its length. Pterygoids not in contact. Symphysis of mandible one third length of jaw.

Colour. Uniform plumbeous grey, except on the extremity and underside of the lower jaw, where it is white.

Dimensions. Total length 7 ft. 9 in.; tip of snout to dorsal fin 34 in., to pectoral 23; length of anterior margin of dorsal fin 17, of pectoral 14; expanse of tail-flukes 22. Skull 22 inches long, beak 13.75, breadth of skull between orbits 7.5.

Distribution. Indian Ocean. Recorded from Madras, Ceylon, the Malabar coast, and Karachi, and said to be common in tidal estuaries in Burma.

391. *Steno perniger.* *Elliot's Dolphin.*

Delphinus perniger, *Elliot*, *Blyth*, *J. A. S. B.* xvii, pt. 1, p. 250; *Blyth*, *Cat.* p. 91; *Jerdon*, *Mam.* p. 157.

Delphinus (*Steno*) *gadamu*, *Owen*, *Tr. Z. S.* vi, p. 17, pls. iii, iv (1866).

Sotalia gadamu, *Flower*, *P. Z. S.* 1883, pp. 489, 513; *True*, *Delphinidæ* pp. 13, 154, pl. ii, figs. 1, 2; *W. Sclater*, *Cat.* p. 325.

Tursiops perniger, *W. Sclater*, *Cat.* p. 323.

Gadamu, Telugu.

Snout long and compressed; pectoral and dorsal fins falcate and of similar size, the pectorals long, nearly $\frac{1}{2}$ of the total length; caudal ridges prominent.

Teeth about $26\frac{28}{28}$ (varying from 23 to 28). Rostrum less than $\frac{2}{3}$ length of skull; its breadth at the middle about $\frac{1}{4}$ its length. Pterygoids close together on median line, but not in contact. Symphysis less than $\frac{1}{3}$ length of mandible.

Colour. Upper parts dark plumbeous grey, almost black upon the fins, becoming paler on the sides and passing into pinky ashy grey, with a few small irregular darker blotches, on the breast and abdomen.

Dimensions. Total length of an adult female 6 ft. 10 in.*; tip of snout to dorsal fin 36 inches; length of base of dorsal 13, length of anterior margin of dorsal 16, of pectoral 18; expanse of tail-flukes 22 (Owen). Skull 17 inches long, rostrum 10, breadth of skull between orbits 6.75.

Distribution. Indian Ocean. Recorded from Vizagapatam and Karachi in India, and from Australia.

Mr. W. L. Slater has sent to me the rostrum of *D. perniger* from the type skin preserved in the Museum, Calcutta (the rest of the skull is not preserved). I have compared this rostrum with that of the typical skull of *S. gadamu* in the British Museum, and find the two identical.

392. *Steno lentiginosus.* *The speckled Dolphin.*

Delphinus (*Steno*) *lentiginosus*, Owen, *Tr. Z. S.* vi, p. 20, pl. v, figs. 2, 3.

Sotalia lentiginosa, Flower, *P. Z. S.* 1883, pp. 480, 513; *True, Delphinidæ*, pp. 15, 155, pl. ii, fig. 3; *W. Slater, Cat.* p. 325.

Delphinus lentiginosus, Sterndale, *Jour. Bombay N. H. Soc.* ii, p. 51.

Bolla gadimi, Tel.

General form similar to that of *S. perniger*, but with smaller and less falcate pectoral and dorsal fins and the tail-flukes wider from front to back. The dorsal fin is longer at its base, being about $\frac{2}{3}$ of the total length. Length of pectoral about $\frac{1}{3}$ of total. Caudal ridges prominent.

Teeth about $34\frac{34}{35}$. Breadth of rostrum at the middle $\frac{1}{4}$ its length.

Colour. "Pretty uniformly bluish cinereous or slaty, freckled with irregular small spots of brown or plumbeous pigment, the streaks longitudinal and flecked with white (Owen, probably from

* Unfortunately it is not stated whether the measurements were made on the animals by Sir W. Elliot, or merely calculated from the drawings by Sir R. Owen. The same remark applies to the dimensions of *S. lentiginosus* and *S. maculiventer*. I have been unable to trace the original drawings.

the drawing). Sinclair, quoted by Sterndale, describes the colour as "Above (and below behind the anus) rather pale leaden grey, with numerous long drop-shaped spots. Of these the majority, especially on the rostrum, limbs, dorsal fin, and flukes, are pure white, the rest dark slate-colour or black. Below, from the anus forward, the general ground-colour is white, much mottled on the belly with the dorsal ground-colour, less so on the breast, and the mental (chin) region almost pure white; but there are a few black spots." There is probably some variation.

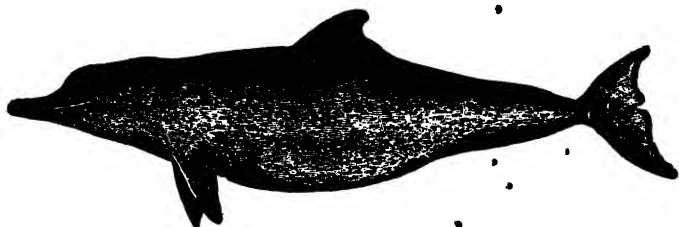


Fig. 190.—*Steno lentiginosus*. (From Elliot's figure.)

Dimensions. Total length of an adult female (Vizagapatam) 7 ft. 10 in.; tip of snout to dorsal fin 40 inches, to pectoral 24; length of dorsal along front 13, of pectoral along anterior curve 12; breadth of tail-flukes 21 (Owen). An adult male (Bombay) was 10 ft. 6 in. long, the pectoral 15 in. long, base of dorsal 27, expanse of flukes 27. Skull of female 18 in. long, rostrum 11, breadth of skull between orbits nearly 7.

Distribution. Indian seas. The species has been obtained at Vizagapatam and at Alibág near Bombay. I also refer to it a skull now in the Museum of the College of Surgeons, that was obtained by Mr. Holdsworth at Aripo in Ceylon, and noticed by Prof. Flower (P. Z. S. 1883, p. 488) as closely resembling *Sotalia sinensis*. There are 31–32 teeth on each side of the upper jaw. The skull is 18·75 inches long (basal length) and 8 broad.

393. *Steno? maculiventer*. *The spot-bellied Dolphin.*

Delphinus (*Steno?*) *maculiventer*, Owen, *Tr. Z. S.* vi, p. 21, pl. vi, figs. 1, 2.

Surva, Telegu.

Teeth $\frac{27}{30}$. Pectoral and dorsal fins falcate, pectoral apparently about $\frac{1}{6}$ of total length.

Colour. Above deep shining plumbeous black, becoming paler below; from the chin to the anus ashy grey, with irregular dark spots or blotches.

Dimensions. Length of an adult female 6 ft. 11 inches, of rostrum externally 5 in., from snout to dorsal fin 40, to pectoral 21, length of pectoral along anterior curve 15; vertical height of dorsal fin 8, length of its base 18; expanse of tail-flukes 20 (*Owen*).

Distribution. Vizagapatam.

This is a doubtful species, founded on drawings, no skull having been preserved. As already suggested, it requires comparison with *Tursiops catalania*.

Genus **DELPHINUS**, Linn. (1766).

Syn. *Eudelphinus*, *Prodelphinus*, Gervais (1880).

Snout long, separated by a groove from the forehead. Dorsal and pectoral fins falcate.

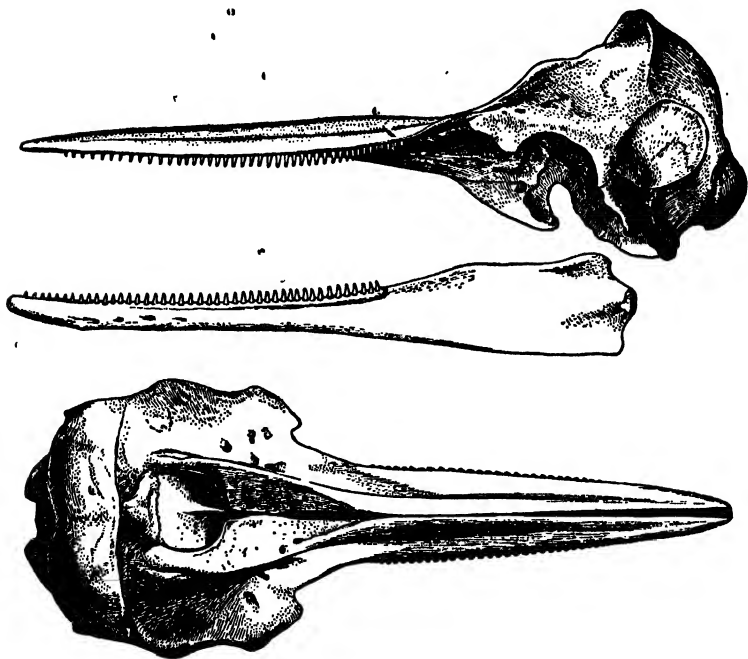


Fig. 191.—Skull of *Delphinus delphis*; from the side and above.

Rostrum long and narrow, generally about twice as long as the cranial portion of the skull. Pterygoids narrow, compressed, sharply keeled, in contact. Mandibular symphysis short. Teeth small ($\frac{1}{10}$ to $\frac{1}{8}$ inch in major diameter), acutely pointed, and numerous (41 to 65 on each side of each jaw), oval in section towards the

base, the longer diameter across the jaw. Vertebrae 73 to 76; in *D. delphis* C. 7, D. 14-15, L. 21-22, C. 30-32.

I include *Prodelphinus*, which only differs in having a flatter palate.

Synopsis of Indian Species.

A. Palate with deep and broad lateral grooves proximally.

a. Teeth $\frac{47}{46}$ to $\frac{50}{51}$ *D. delphis*, p. 587.

b. Teeth $\frac{65}{58}$ *D. dussumieri*, p. 588.

B. Palate nearly flat; teeth $\frac{40}{40}$ *D. malayanus*, p. 588.

394. *Delphinus delphis*. *The common Dolphin.*

Delphinus delphis, *L. Syst. Nat.* i, p. 108 (1766); *Flower*, *Tr. Z. S.* xi, p. 1, pl. 1; *id. P. Z. S.* 1883, p. 500; *True*, *Delphinidae*, pp. 45, 160, pl. xi, figs. 1-3; *W. Selater*, *Cat.* p. 321.

Delphinus pomeeagra, *Owen*, *Tr. Z. S.* vi, p. 28, pl. vi, fig. 3, pl. viii, figs. 1-4.

Pomigra, Tamul (Madras.)

Body slender, head small. Beak long and narrow; pectoral fins three times as long as broad, narrow in the distal half and acutely pointed.

Teeth $\frac{41}{46}$ to $\frac{50}{51}$, small. Bony palate deeply excavated on each side proximally, the median portion convex.



Fig. 192.—Common Dolphin, *Delphinus delphis*. (Flower, *Art. Mammalia*, 'Encyclopædia Britannica'.)

Colour very variable. The Indian *D. pomeeagra* is said to be almost black, with a rather lighter shade on the belly. In Atlantic specimens the back is usually dark grey, the underparts white or whitish, and the sides occupied by various bands of grey or fulvous.

Dimensions. Total length 7 ft. 6 in., snout to dorsal fin 39.3 inches, to pectoral 20, length of pectoral 14, breadth of flukes 20.5. Length of skull 18.4 inches, breadth between orbits 6.75, length of rostrum 11.

Distribution. Probably all tropical and temperate seas. In India only recorded from the Madras coast.

395. *Delphinus dussumieri*. The Indian long-nosed Dolphin.

Delphinus longirostris, *Dussumier*, *Cuv. Règne An.* éd. 2, i, p. 288 (1829); *Flower*, *P. Z. S.* 1883, p. 503; *True*, *Delphinidæ*, pp. 58, 161, pl. xii, fig. 2; *W. Sclater*, *Cat.* p. 322 [nec *Gray*, *Spic. Zool.* p. 1 (1828)].

Colour and other external characters unknown.

Teeth $\frac{65}{58}$. Rostrum greatly elongate. Symphysis of mandible one fifth the length of the skull. Palatal grooves as in *D. delphis*.

Dimensions. Length of skull 19.5 inches, breadth between orbits 5.75, length of rostrum 13.25.

Distribution. Malabar coast.

The description of the type skull is copied from True. The name *longirostris* cannot stand, as there is a different species to which the name was previously given by Gray, *D. capensis*, Gray, I find, on examining the skull, is quite distinct, having only $\frac{63}{51}$ rather large teeth and a much shorter mandibular symphysis.

D. roseiventris may also occur in Indian seas. It is known from the Moluccas and Torres Straits, and is a small species, rather less than 4 feet long, with $\frac{48}{48}$ teeth, and the bony palate intermediate in form between that of typical dolphins like *D. delphis* and that of aberrant types like *D. malayanus*.

396. *Delphinus malayanus*. The Malay Dolphin.

Delphinus malayanus, *Lesson*, *Voy. Coquille*, *Zool.* i, p. 184, *Atlas*, pl. ix, fig. 5 (1826).

♀ *Delphinus velox*, *Dussum.*, *Cuv. Règne An.* éd. 2, i, p. 288 (1829); *F. Cuv. Hist. Nat. Mam.* pl. 425; *Fucheran*, *Rev. Mag. Zool.* 1856, p. 453.

Steno attenuatus, *Gray*, *Zool. Ereb. & Terror*, p. 44 (1846); *id. Cat. Seals & Whales B. M.* 1866, p. 235; *Blyth*, *J. A. S. B.* xxviii, p. 492, footnote; *id. Cat.* p. 92.

♂ *Prodelphinus attenuatus*, *Flower*, *List Cetacea B. M.* 1885, p. 30; *W. Sclater*, *Cat.* p. 324.

Prodelphinus malayanus, *True*, *Delphinidæ*, pp. 67, 165, pl. xvi, figs. 1, 2.

Teeth about $\frac{40}{40}$. No lateral grooves on bony palate.

Colour uniform ashy grey.

Dimensions. Total length 6 ft. 3 in., height of dorsal fin 8.5 inches, length of pectoral 13.8, expanse of tail 24. A skull is 15.5 inches long, 6 broad across the orbits; length of rostrum 9.5.

Distribution. Indian Ocean, obtained in the Bay of Bengal near the Sundarbans.

There is much confusion regarding *Delphinus malayanus*, *D. attenuatus*, and *D. franatus* (*D. doris*, Gray), all of which have been reported from the Indian Ocean. The skulls are very similar; but True has collected evidence showing some important distinctions in

coloration—*D. malayanus* being uniform ashy, *D. attenuatus* dark above, ashy grey below, and *D. frænatus* dark above, white below, the dark parts spotted or speckled with white. The number of vertebræ is also different. The specimen described by Blyth agreed in colour with *D. malayanus*; but if the other forms deserve separation, it is probable that one or both of them will be found on the Indian coasts. *D. longirostris*, Gray, with teeth $\frac{52}{52}$, may also occur*.

Delphinus velox is not mentioned by True, and must remain a doubtful species for the present. It was founded on a specimen, one of a very numerous shoal, that was harpooned at sea between Ceylon and the Equator. The dorsal and pectoral fins were much falcate, the teeth $\frac{41}{41}$; the colour black throughout. The length of the specimen was 5 feet, the height and base of the dorsal fin each about 5.5 inches, the pectoral 10 inches long, expanse of the tail 13. The movements of these dolphins were very swift, hence the name. The type may have been a young *D. malayanus*.

Family PLATANISTIDÆ.

The last family of Cetacea is composed of three genera, each containing a single species. All are fluviatile or estuarine; two are South-American (one, *Inia*, inhabiting the river Amazons, the other, *Pontoporia*, living in the Rio de la Plata estuary), and the third, *Platanista*, is Indian. This distribution may indicate that the family, which in some respects is less specialized than other Cetaceans, was once marine and widely spread, and that the few living representatives, as in the parallel case of Ganoid and Dipnoan fishes, owe their survival to their adaptation for a life in rivers, where the struggle for existence is less severe than in the sea.

The size of the *Platanistidæ* is relatively small. Teeth are numerous in both jaws, which are long and narrow. The symphysis exceeds half the length of the mandible. The head is divided from the body by a slightly constricted neck. The cervical vertebræ are all free. The tubercular and capitular articulations of the ribs are distinct in front and blend gradually behind as in ordinary mammals. Pterygoids elongate, in contact, not involuted.

Genus PLATANISTA, Wagler (1830).

A long compressed beak, slightly enlarged at the extremity; dorsal fin rudimentary, replaced by a low ridge; pectoral fin

* Owen (Tr. Z. S. vi, p. 23) calls *D. longirostris*, Gray, the Black Dolphin of the Cape and Ceylon. There is probably some confusion with *D. longirostris*, Cuv. (*D. dussumieri*, ante, p. 588), from Malabar.

triangular, fan-shaped; eye very minute, rudimentary, without a crystalline lens; blowhole longitudinal, linear. A small cæcum. No pelvic bones.

Teeth rather large, conical, circular in section, and sharp-pointed in the young, gradually becoming worn down and acquiring enlarged

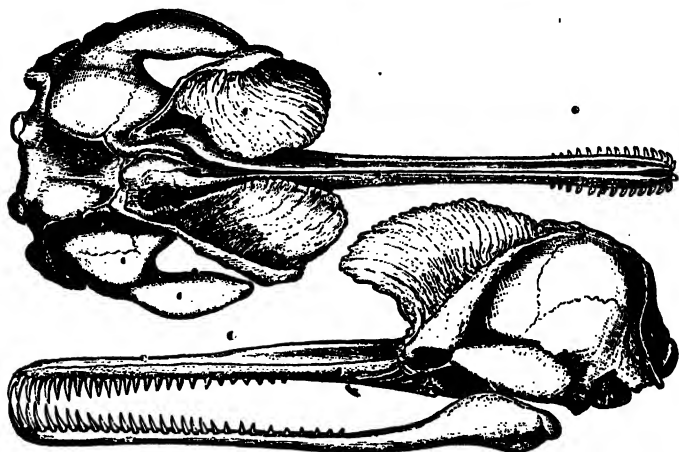


Fig. 193.—Skull of *Platanista gangetica*, young. (Copied from Sterndale.)

flattened roots. Symphysis one half (in males) to two thirds (in old females) the length of the mandible, the teeth on the two sides in the anterior part of the rostrum and mandible being so close together as almost to touch. Proximal portion of maxillæ bearing very high, longitudinal, incurved bony crests, which bend over and almost meet above. Zygomatic process of squamosal very broad. Vertebrae: C. 7, D. 10–11, L. 8–7, C. 26=51.

A full account of the anatomy, distribution, and habits of the only member of this genus has been given by Anderson.

397. *Platanista gangetica*. *The Gangetic Dolphin*.

Delphinus gangeticus, Lebeck, *Neue Schr. Ges. nat. Freunde Berl.* iii, p. 280 (1801); Roxburgh, *As. Res.* vii, p. 170, pl. v (1801).

Platanista gangetica, Gray & Hardw. *Ill. Ind. Zool.* ii, pl. xxiv; Eschricht (translated by Wallich), *A. M. N. H.* (2) ix, pp. 161, 279, pls. v–vii; Blyth, *Cat.* p. 92; Jerdon, *Mam.* p. 159; Anderson, *An. Zool. Res.* p. 417, pls. xxv, &c.; W. Sclater, *Cat.* p. 315.

Platanista indi, Blyth, *J. A. S. B.* xxviii, p. 493; *id.* *Cat.* p. 92; Jerdon, *Mam.* p. 159.

Sús, *Súsú*, H.; *Súsúk*, *Sishúk*, Beng.; *Sisúmar*, Sans.; *Bhulan*, *Súnsar*, Sind.; *Hího*, *Seho*, Assam; *Húh*, Sylhet.

Rostrum much shorter in males than in females. Teeth about 30 on each side, generally rather more below than above.

Colour blackish throughout.

Dimensions. Very variable; adults usually 7 to 8 feet long, but a specimen from the Jumna in the Allahabad Museum is said to measure 12 feet. Females are larger than males. In a female 89 inches long the anterior border of the pectoral fin measured 12·5, and the expanse of the tail 19. A large female skull measured 27·25 inches in basal length and 40·25 in greatest breadth; a large male skull 19·4 by 8·9.



Fig. 194.—*Platanista gangetica* (Flower, Art. Mammalia 'Encyclopædia Britannica').

Distribution. Indus, Ganges, and Brahmaputra, with all their larger tributaries, from the sea to the base of the mountains. This dolphin is common in tidal waters, but never enters the sea.

Habits. According to Anderson the Gangetic dolphin is not gregarious, although several individuals may be seen about the same part of the river. It keeps chiefly to the deeper channels and is probably migratory to some extent, as none are seen in the Hoogly near Calcutta during the hot season from March to June, though many may be noticed in the cold months from October to March. In the rains (June to October) this dolphin undoubtedly remains in the tidal waters, for it is frequently captured, though it is seldom observed. It rises to breathe like other dolphins, remaining but a very short time at the surface. Sometimes in the cold months it throws itself out of the water.

This cetacean is quite blind; sight would be useless in the thick muddy waters of the Indus at all times of the year, and of the Ganges and Brahmaputra at most seasons. Its food consists of fish and prawns, and amongst the former Anderson found the remains of mud-haunting Siluroids. Doubtless these are captured by the *Platanista* feeling for them on the mud with its snout.

The period of gestation is said to be eight or nine months; the young, almost always one in number, very rarely two, are born between April and July, and it is stated that the young dolphin at times holds on by its mouth to the base of the mother's pectoral fin. These details require confirmation.

Platanista is captured by fishermen in parts of the country, either by nets or by harpooning. The flesh is eaten by particular castes, and the oil is used for burning and other purposes.

Order SIRENIA.

The Manatees and Dugongs, formerly classed with the *Cetacea*, and subsequently assigned by De Blainville and others to the *Ungulata* (or *Pachydermata*), are now placed in a separate order, the *Sirenia*, which has certainly no affinity to Cetaceans and very little, if any, to Ungulates. The *Sirenia* resemble *Cetacea* in their fish-like form, in the absence of external hind limbs and of a distinct sacrum, and in the rudimentary condition of the pelvis, in the horizontal expansion of the tail to form a swimming organ, in the pectoral limbs being converted into paddles without separate digits, in the small eyes, and in the want of an ear-conch. On the other hand, the head is of moderate size and rounded, the nostrils are always separate, valvular, and anteriorly situated, the mouth small and the teeth, in all living forms, of two kinds, incisors and molars; there is no dorsal fin; and hairs or bristles occur on the lips at all ages and are sometimes scattered over the body. The muzzle is truncated, and horny plates, doubtless used in mastication, are developed on the anterior portion of the palate and of the lower jaw.

The bones are dense and massive. The skull is peculiarly formed, but very unlike that of any Cetacean. The anterior narial aperture is large and high in position, and the nasal bones are generally wanting in living forms. There is a thick rostrum, chiefly formed by the premaxillaries. The flat ends of the bodies of the vertebræ do not ossify separately, as in nearly all other mammals. The radius and ulna are generally united together at both ends. The digits are five in number, and the phalanges, which are never more numerous than in ordinary Mammalia, are flattened. The stomach is compound, the intestines long, and there is a cæcum. The testes are abdominal, the uterus bicornuate, and the placenta non-deciduous and diffuse. The mammæ are two in number and are pectoral and postaxillary.

The order contains only one family and two living genera, which are purely herbivorous, feeding on aquatic plants, and which inhabit shallow seas, estuaries, and rivers. They are never found out at sea, like *Cetacea*, nor do they ever voluntarily go ashore.

Family MANATIDÆ.

Characters of the order. Of the two living genera one, *Manatus*, is found in rivers and estuaries on both sides of the tropical Atlantic, the other, *Halicore*, inhabits the coasts of the Indian Ocean.

A third genus, *Rhytina*, formerly lived on the shores of Behring's Island, but has been extinct for more than a century.

In Flower and Lydekker's 'Introduction to the Study of Mammals,' each of the genera named is classed as the type of a family.

Genus **HALICORE**, Illiger (1811).

Nostrils on upper part of muzzle. Tail crescent-shaped, concave behind. Pectoral fins ovate. No nails on digits.

The thick rostrum and the mandibular symphysis bent downward. Teeth altogether, i. $\frac{4}{3}$, m. $\frac{5-5}{5-5}$; but only two upper incisors are found in adults and two or three molars on each side above



Fig. 195.—Skull of *Halicore dugong*.

and below. The adult incisors are rootless, straight, tusk-like, large in the male, not exerted in the female. The anterior molars are circular in section, and increase in size backward, the last appears as if formed of two cylinders joined together; the anterior molars fall out before the posterior molar appears above the gum, All are rootless and destitute of enamel.

Three species have been described; but it is doubtful whether *H. tabernaculi*, from the Red Sea, and *H. australis*, from Australia, are distinct from the Indian species *H. dugong*.

398. *Halicore dugong.* *The Dugong or Duyong.*

Trichechus dugong, *Erzleben, Syst. Reg. An.* p. 599 (1777).

Halicore dugong, *Illiger, Prod.* p. 140; *Gray & Hardw. Ill. Ind. Zool.* ii, pl. xxii; *Blyth, J. A. S. B.* xxviii, pp. 271, 483, 494; *id. Cat.* p. 143; *id. Man. Birds Burma*, p. 53; *Jerdon, Mam.* p. 311; *W. Slater, Cat.* p. 326.

Halicore indicus, *Desm. Mam.* p. 509; *Cantor, J. A. S. B.* xv, p. 274; *Kelaart, Prod.* p. 89.

Talla mala, *Muda ura*, Cing.; *Duyong*, *Parampuan laut*, Malay.

Colour either bluish grey throughout or the lower parts whitish or white.

Dimensions. Extreme length of adults 8 to 9 feet, usually 5 to 7; much larger dimensions are given in books, but are open to doubt.

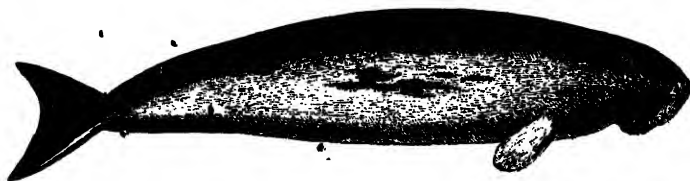


Fig. 196.—*Halicore dugong.*

In a large specimen 8 ft. 6 in. long and 6 ft. in circumference, the pectoral fins were 16 inches long and 8 inches broad, and the breadth of the tail from tip to tip 31. The skull of a male from Ceylon measures 14·5 inches in basal length and 8·5 in breadth.

Distribution. The shores of the Indian Ocean from E. Africa to Australia for about 15 degrees on each side of the Equator. Dugongs have been observed on the coast of Malabar, the north-west coast of Ceylon from the Gulf of Calpentyn to Adam's Bridge, around the Andaman Islands, and in the Mergui Archipelago.

Habits. Formerly dugongs were said to be found in large herds of some hundreds of individuals, and to be in places so tame as to allow themselves to be handled. As their flesh is by all accounts excellent and their fat yields a clear limpid oil of great value, they have everywhere been hunted and are now in most places rare. They are said to be slow in their movements and unintelligent. Their food consists of marine algæ. They haunt shallow bays, salt-water inlets, and mouths of estuaries, but do not, like the Manati, ascend rivers. The female gives birth to but one young at a time, and is said to hold it with her pectoral fin. Some writers have suggested that the dugong has given rise to the myth of the mermaid (hence, indeed, the name *Halicore*); but it should be remembered that stories of beings half man or woman, half fish, are as common in temperate as in tropical seas, and that some of them are more ancient than any European knowledge of the dugong.

The last order of placental mammals, containing the Sloths, Anteaters, Armadillos, Cape Anteaters, and Pangolins or Scaly Anteaters, is quite as distinct from all other mammalian orders as the Cetacea and Sirenia are; but it is far less homogeneous than either, there being very few structural characters common to all the different suborders included in it, except the absence of teeth in the front of the jaw. In some of the Edentates, as in the only Indian genus belonging to the order, teeth are entirely wanting; when teeth are present they are rootless, destitute of enamel, and similar to each other in shape, and, with a single exception (the genus *Tatusia*, an armadillo), there are no milk-teeth. All known species of Edentates are terrestrial or arboreal and resemble ordinary mammals in external form.

As only one genus is found in India it is unnecessary to describe here the very great structural differences of the various suborders and families. These are, according to Flower's latest classification (P. Z. S. 1882, p. 358):—I. Suborder Pilosa, containing the families (1) *Bradypodidae* and (2) *Myrmecophagidae*, both South-American; II. Loricata, with the family (3) *Dasypodidae*, also South-American; III. Squamata, consisting of the (4) *Manidae*, Asiatic and African; and IV. Tubulidentata, containing the (5) *Orycteropodidae*, confined to Africa.

Suborder *SQUAMATA*.

No teeth. The whole upper surface and the sides of the body and tail covered with large imbricate horny scales. Limbs short, 5 toes on each foot. Tongue long, vermiform, capable of great protrusion. Uterus bicornuate. Placenta diffused and non-deciduate. No cæcum.

A single family with only one living genus.

Family *MANIDÆ*.

Genus *MANIS*, Linn. (1766).

Head small, long and pointed in front; mouth very small. Eyes small. Ear-conch small or rudimentary. The upper part of the head, the back and sides of the body, the whole tail, and the outside

of the limbs covered with large imbricate scales ; lower surface of head and body, sides of head, and inner surface of limbs scaleless, scantily covered with hair. Generally there are a few coarse hairs between the scales. All the toes bear slightly curved claws, those

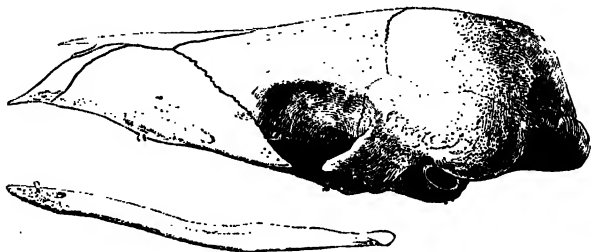


Fig. 197.—Skull and lower jaw of *Manis pentadactyla*.

on the fore feet longer than those on the hind, third claw the longest on all feet, claws of pollex and hallux short. In walking, the dorsal surfaces and outer sides of the phalanges belonging to the two outer digits of the fore feet rest on the ground, so that the animal walks with its fore toes doubled under the feet. The hind feet are plantigrade and, as a rule, rest on the ground normally.

The skull is of very peculiar shape ; it is rounded behind, and diminishes gradually in front, being almost conical ; it is quite



Fig. 198.—Lower jaw of *Manis pentadactyla*, from above.

smooth, without any crests. The zygomatic arch is imperfect, there being no malar bone. There is no distinction between the orbits and the temporal fossæ. Palate long and narrow, produced far backwards ; the pterygoids extend backwards to between the tympanics, each of which forms a small crescentic bulla. Rami of mandible very slight and straight, without angle or coronoid process, but each ramus bears anteriorly on its upper border a small pointed process projecting outwards. No clavicles. No third trochanter to the femur. Ungual phalanges bifid distally. Two pectoral mammæ. Stomach with thick muscular walls, especially towards the pyloric end, and with a special gland near the middle of the great curvature. A gall-bladder present.

The Pangolins or Scaly Anteaters are burrowers and live entirely

on ants and termites, the long extensile tongue being used for the capture of the insects. They roll themselves into a ball for defence, and exhibit an enormous muscular power that defies any ordinary attempt to unroll them.

The genus inhabits the Oriental and Ethiopian regions, the African forms being rather more numerous than the Asiatic and exhibiting more variety. The three Asiatic species agree with each other in having the tail tapering, the limbs entirely covered with scales outside, and the middle row of scales above the tail continuous to the end. All three occur within our area.

Synopsis of Indian, Ceylonese, and Burmese Species.

A. Fore claws about twice length of hind claws.

a. 11 to 13 rows of scales round body *M. pentadactyla*, p. 597.

b. 15 to 18 rows of scales round body *M. aurita*, p. 599.

B. Fore claws but little longer than hind claws. *M. javanica*, p. 599.

A characteristic terminal phalanx of a large species of *Manis*, closely allied to the African *M. gigantea*, has been found in the Pleistocene cave-deposits of Kurnool. Another phalangeal bone, referred to the genus *Macrotherium*, has been described from the Lower Siwalik of Sind; but this genus, I am informed by Mr. Lydekker, is probably ungulate, not edentate as formerly supposed.

399. *Manis pentadactyla*. The Indian Pangolin.

Manis pentadactyla, L. *Syst. Nat.* i, p. 52, partim (1766); Sykes, *P. Z. S.* 1831, p. 104; Horsfield, *Cat.* p. 196; Blyth, *J. A. S. B.* xi, p. 453; xvi, p. 1273, pl. iv; *id.* *Cat.* p. 179; *Jerd. Mam.* p. 314; Anderson, *An. Zool. Res.* p. 341, pl. xxiv, figs. 1, 2; W. Selater, *Cat.* p. 330.

Manis brachyura, *Erxl. Syst. Reg. An.* p. 98 (1777), partim; Blyth, *J. A. S. B.* xii, p. 181.

Manis crassicaudata, Geoffr. *St.-Hilaire, Cat. Mam.* p. 213, partim (1803); Elliot, *Mad. Jour. L. S.* x, p. 218; Tickell, *J. A. S. B.* xi, p. 221; Kelaart, *Prod.* p. 74.

Pholidotus indicus, Gray, *P. Z. S.* 1865, p. 368.

Bājra-Kūt, Sanscr. and H.; *Bājra Kapta*, *Surāj-mukhi*, *Silu*, *Sāl Sālū*, *Sakunphor*, H.; *Kishaur*, Pushtu; *Challa*, *Mirān*, Sind; *Shālma*, Bauri; *Armū*, Kol; *Thiriya*, *Kauli-mah*, *Kauli-manjra*, *Kassoli-manjur*, Mahr.; *Alawa*, Tel.; *Alangū*, Tam. and Mal.; *Kabalaya*, Cing.; *Banroku* (jungle carp), Deccan, &c.; *Keyot-mach*, Rangoon; *Kut-pohu*, Bengal.

Body and tail stout. Claws of fore feet very long, the middle fore claw double the length of the middle hind claw. Scales on body large, none keeled, as a rule, in adults. There are 11 to 13 longitudinal rows of scales round the body, 14 to 17 in the median (longitudinal) row above the tail, the tail being taken to commence where the scales at the sides become angulate. The scales are about twice as broad as in the other two Indian species.

Colour of scales light yellowish brown throughout; naked skin flesh-coloured, nose more livid.

Dimensions. Head and body of a male 24·5 inches, tail 18, of another specimen 26 and 18. Ceylon specimens appear to have longer tails; Kelaart gives head and body 23·5, tail 22·5, Hornaday for a female 19 and 17. A skull measures 3·25 in basal length greatest breadth 1·75. Weight of adults 20 to 27 lb.; of a large specimen 42, according to Kelaart.

Distribution. India proper and Ceylon. This species is found on the mainland from Peshawar (Stewart, J. A. S. B. xxxii, p. 235) and Sind (probably also Baluchistan) to Bengal and Orissa, and from the base of the Himalayas to Cape Comorin. It is not reported from any part of the Himalayas, though it probably occurs in the lower ranges to the westward. Jerdon's statement that it was found by Hodgson in Nepal appears due to some mistake. It occurs on the Shevroy hills, Madras Presidency, up to at least 8500 feet above the sea.

Habits. Good accounts have been given by Elliot and Tickell. Like other species of the genus, this pangolin, as a rule, only moves about at night, and hides during daylight in burrows dug by itself or amongst rocks. I, however, once in Orissa found an adult moving about in jungle some time after sunrise. The burrow, according to Elliot, descends in a slanting direction to a depth of from 8 to 12 feet below the surface and ends in a large chamber about 6 feet in circumference, in which the pangolins live in pairs, with, at times, one or two young. The entrance to the burrow is closed with earth when the animals are in it.

The food consists of various kinds of ants and termites, especially of the latter. The ants' nests are torn open by the powerful claws of the Manis, which thrusts its long tongue into the passage-ways and then withdraws it with numerous ants adhering to it. This animal also drinks (in confinement) by rapidly extending and withdrawing its tongue; whether it drinks frequently or at all in the wild state may be questioned, for it often inhabits places where no water is procurable. Stones have repeatedly been found in the gizzard-like stomach and may aid, as in birds, in triturating the food. Blyth gave to a Manis that had been starved for some time chopped raw meat and cooked egg and rice, on which the animal fed freely after nightfall, but it died soon after, probably from repletion.

The only sound known to be produced by this animal is a hissing noise that it makes when annoyed. In confinement it soon grows tame, but there is often some difficulty in feeding it. It walks very slowly, with the back well arched, and is in the habit of standing up on its hind feet with the body not vertical, but inclined forward.

The breeding-habits are imperfectly known. A single young one is generally produced, more rarely two, in the Deccan from January to March, according to Elliot. In the Shevroy hills, however, a female kept for some time by Mr. W. H. Daly produced a young one weighing 1 lb. on July 11th.

400. *Manis aurita*. *The Chinese Pangolin*.

Manis pentadactyla, *L. Syst. Nat.* i, p. 52 (1766), partim.

Manis aurita, *Hodgson, J. A. S. B.* v, p. 234 (1836); *Blyth, Cat.* p. 179; *Jerdon, Mam.* p. 316; *Anderson, An. Zool. Res.* p. 352, pl. xxiv, figs. 3, 4; *Jentink, Notes Leyd. Mus.* iv, p. 202; *W. Slater, Cat.* p. 330.

Manis javanica, *Blyth, J. A. S. B.* xi, p. 454, xvi, p. 1274, *nec Desmarest*.

Bájarkit, H.; *Sálak*, Khas; *Kwengnya*, Newári.

Body and tail more slender than in *M. pentadactyla* and scales much smaller and darker coloured. Fore claws long; middle fore claw twice as long as middle hind claw. Scales without keels in adults or only 3 or 4 outer rows on body keeled. Round the body the longitudinal rows are 16 to 18 in number, usually 17; 16 to 20 scales in the median row above the tail. More hair between the scales than in other Indian forms, and the carapach is more developed.

Colour. Scales dark brown throughout in adults, sometimes with pale concentric bands in young animals; naked parts flesh-coloured.

Dimensions. Head and body 19 to 23 inches, tail 13 to 15. A skull measures 3.5 in basal length, 1.6 in greatest breadth. Weight of adults 15 to 17 lb.

Distribution. Himalayas as far west as Nepal, at moderate elevations, Assam, hills north of Bhámo, Karennie, and Southern China (Amoy, Hainan, Formosa).

Habits, so far as known, similar to those of the last species.

401. *Manis javanica*. *The Malay Pangolin*.

Manis javanica, *Desmarest, Mamm.* p. 377 (1822); *Cantor, J. A. S. B.* xv, p. 259; *Horsfield, Cat.* p. 197; *Blyth, Cat.* p. 179; *Anderson, An. Zool. Res.* p. 352, pl. xxiv, figs. 5-8; *Jentink, Notes Leyd. Mus.* iv, p. 199; *W. Slater, Cat.* p. 331.

Manis leptura, *Blyth, J. A. S. B.* xi, p. 454, xvi, p. 1273; *id. Cat.* p. 180.

Manis leucura, *Blyth, J. A. S. B.* xvi, p. 1274.

Pangolinus leucurus, *Blyth, Mam. Birds Burma*, p. 53.

Theng-khwe-khyat, Burmese; *Pangoling*, *Tangiling*, Malay.

Form more slender than in either of the preceding species and tail generally longer. Fore claws but little longer than the hind, never more than half as long again. Scales longer, more pointed behind, and rather less closely adpressed, the posterior edges chipped, not worn, and with a median keel frequently visible in adults, especially on the tail, sides, and limbs; 15 to 19 rows (usually 17) round the body, 20 to 30 (usually 24 to 27) scales in the median row above the tail.

Colour dark brown, the sides and the terminal portion of the tail sometimes whitish, and all the scales in a few instances particoloured. Naked skin whitish.

Dimensions A large male measured, head and body 21·5 inches, tail 20; basal length of a skull 4·1, greatest breadth 1·75.

Distribution. From Sylhet and Tipperah, and from the lower ranges near Bhámo, throughout Burma, Cochinchina, and Cambodia, the Malay Peninsula, Sumatra, Java, and Borneo to Celebes. I have not been able to ascertain whether this species or *M. aurita* inhabits the hills south of Assam.

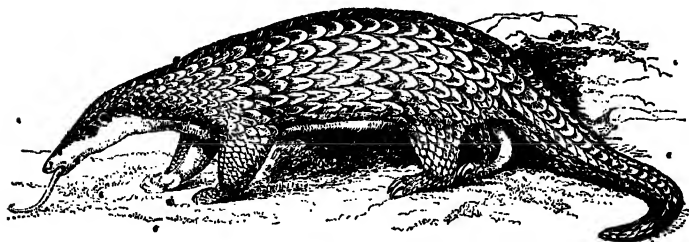


Fig. 199.--*Manis javanica*. (From a drawing by Col. Tickell.)

Habits. From Tickell's MS. notes it may be inferred that this species sometimes turns both fore and hind claws under the feet in walking. It is probably less of a burrower than the other two species, as its fore claws are much smaller and its scales less worn. S. Müller states that in Java it ascends trees and conceals itself in fissures, especially in several kinds of fig-tree; but it also burrows in the earth, though it is rarely found amongst rocks. Similar statements as to its habits in Borneo are made by Motley and Dillwyn (Nat. Hist. Labuan. p. 51).

APPENDIX AND ERRATA.

Introduction, p. iv, line 27, for 'some of these forms' read 'some of the Ethiopian and Palearctic types.'

P. 1. Add to the characters of Mammalia the following:—

The occipital condyle is double. Each ramus of the lower jaw is composed of a single piece and articulates directly with the squamosal, no quadrate bone intervening.

Pp. 7, 9. The hoolock, according to Mr. Sterndale's observations, sometimes drinks in the ordinary way, sometimes by dipping its hand in water, and licking the drops off its fingers.

P. 23, line 10 from bottom, for 'longer' read 'shorter.'

P. 42. This footnote, I am informed by Mr. Theobald, is not quite accurate. The collection of skulls was made over by Mr. Theobald to Dr. Oldham without reservation and was presented by the latter to the British Museum. The specimens are therefore correctly labelled as presented by Dr. Oldham. The essential fact is that the collection was made by Mr. Theobald, as stated.

P. 50, line 9, for 'heel' read 'keel.'

P. 54, lines 11 and 13 from bottom, for 'cusp' read 'lobe.'

P. 60. A tiger killed by Mr. Hornaday in the Anaimalai forest, South India ('Two Years in the Jungle,' p. 159), measured 9 feet 8½ inches long to the end of the tail-vertebræ, and weighed 495 lb. Weights of Cooch Behar tigers varying from 450 to 493 lb. are given in the 'Asian' (April 3rd, 1891, p. 3). There can be no question as to Mr. Hornaday's accuracy, and it is evident that some tigers are much heavier than those weighed by Elliot and Sanderson. Forsyth's estimate of 450 to 500 lb. is clearly not excessive as it appeared. Tigresses 9 feet 11 inches and 10 feet 2 inches long are recorded by Mr. F. A. Shillingford ('Asian' Sept. 18th, 1891).

P. 112, line 1, for '*P. zeylonensis*' read '*P. aureus*.'

P. 143. It would be better to adopt the spelling *deccanensis* for the specific name of the wild dog.

Pp. 182-188. Mr. Thomas has published (P. Z. S. 1889, p. 190) some important notes on the characters and synonymy of different species of otter. He has come to the conclusion that the type of *Lutra aureobrunnea* is, as I suggested, a dyed skin of a young *L. vulgaris*, and he is convinced that the skull described by Gray as *Barangia nepalensis* belonged to a female *L. vulgaris*, dwarfed by captivity. Thus these species may be entirely dismissed as fictitious, a conclusion in which I agree. The other three Indian species remain as described in the text; but Mr. Thomas shows that the clawless otter, *Lutra leptonyx* of Horsfield (1824), must take the earlier title of *L. cinerea*, Illiger (1815). He applies to the otter called in the present work *L. ellioti* the name *L. barang*, F. Cuv. (1823). But Dr. Scully, being in Paris, re-examined Cuvier's type of *L. barang* and found that it belonged to *L. vulgaris*. As, however, Mr. Thomas has also shown, the otter named by Dr. Gray *L. macrodus* (P. Z. S. 1865, p. 128), and supposed to have been brought from Brazil, is really the smooth Indian otter, and con-

sequently this name will have to be used. The following is the revised nomenclature:—

No. 92, p. 182. *Lutra vulgaris*.

No. 93, p. 185. *L. macrodus*.

• No. 94 must be omitted altogether.

No. 95, p. 187. *Lutra cinerea*.

P. 221. I have now seen a specimen of No. 110, which, following Dobson, I called *Gymnura suilla*. I regard it as generically distinct from *Gymnura*, and it should, I think, stand as *Hylomys suillus*. Under these circumstances the name to fig. 59, p. 222, will not need correction.

P. 227. The last footnote is erroneous and due to a mistake.

P. 240. I was informed by Dr. Day, shortly before he died, that the type specimen of *Crocidura dayi* was from Trichur in Cochin, and was brought to him by a tank-digger.

P. 253, line 2, for '*Scotophilus*' read '*Nycticejus*.'

P. 265, No. 142. *Cynopterus blanfordi*, Thomas (not Doria & Thomas). The description has appeared, Ann. Mus. Civ. Genova, (2a) x, p. 884.

P. 317. Add after No. 190:—

Vesperugo tylopus, Dobson, P. Z. S. 1875, p. 473; *id.* Mon. As. Chir. p. 114; *id.* Cat. Chir. B. M. p. 236.

This bat belongs to the subgenus *Vesperugo*, with two upper premolars on each side, but has the lower surface of the basal half of the thumb and the soles of the feet furnished with fleshy pads as in *V. (Vesperus) pachypus*, p. 307. See P. Z. S. 1876, p. 532, pl. lv, figs. 3, 3a. Forearm 1·2 inches.

Originally described from North Borneo, recently found by Mr. L. Fea in Karennee.

P. 325. Add after No. 198:—

Harpyiocephalus auratus, M.-Edw. Rech. Mam. p. 250, pl. xxxvii b, fig. 1, and pl. xxxvii c, fig. 2 (1872); Dobson, Mon. As. Chir. p. 153; *id.* Cat. Chir. B. M. p. 279.

In this species the first upper premolar is smaller than the second, as in *H. suillus* and *H. tubinaris*, but the upper third of the outer margin of the ear-conch is convex or straight. Each nostril forms a distinct tube directed sublaterally, with a circular aperture marked by a very small notch on the outer and upper margin. Forearm 1·1 inch. Colour of fur black, above with golden-yellow tips, below with white.

Described from Eastern Tibet. A dried skin has been discovered by Mr. Thomas amongst some specimens from Sikhim formerly belonging to me.

Also add:—

Harpyiocephalus feæ, n. s., Thomas, Ann. Mus. Civ. Genova, (2a) x, p. 884; thus described:—

"Allied to *H. auratus*, M.-Edw., but distinguished by the colour being brown instead of golden-yellow, by the smaller nasal tubes, and by having the forearms, hind limbs, and posterior edge of the interfemoral membrane almost naked. Anterior lower premolar very markedly shorter than the canine. Distinguished from *H. leucogaster* by its smaller size, smaller ears, and by the inner upper incisor not being longer than the outer. Forearm 20 mm (1·14 inches)." Found by Mr. L. Fea in Karennee.

P. 335. *Vespertilio dobsoni*. Mr. Thomas informs me that he finds a dried skin in the small Sikhim collection already mentioned.

P. 413. *Mus chiropus*, Thomas, described, Ann. Mus. Civ. Genova, (2a) x, p. 884.

P. 463. It should have been noticed in the text that the identity of the Sumatran and Indian elephant was conclusively demonstrated by Falconer.

ALPHABETICAL INDEX.

- abietum (*Martes*), 160.
 abramus (*Vesperugo*), 313.
 abusalam (*Tursiops*), 581.
 Acanthion, 441.
 Acanthochoerus, 441.
 Acanthomys, 426.
 Acomys, 426.
 acontium (*Alactaga*), 392.
 acuticornis (*Panolia*), 541.
 adversus (*Vespertilio*), 320, 337.
 ægagrus (*Ægoceros*), 502.
 ægagrus (*Oapra*), 502.
 Æluroidea, 53.
 Ælurus, 189.
 æquicaudalis (*Mus*), 406.
 affinis (*Cervus*), 537.
 affinis (*Felis*), 86.
 affinis (*Rhinolophus*), 274.
 affinis (*Sus*), 560.
 affinis (*Vesperugo*), 311.
 africanus (*Vespertilio*), 334.
 agilis (*Hylobates*), 9.
 Ailurus, 190.
 Alactaga, 391.
 albicornis (*Cervus*), 543.
 albidiventris (*Mus*), 416.
 albinus (*Presbytis*), 35.
 albinus (*Sorex*), 234.
 albipes (*Sciurus*), 374.
 albipes (*Semnopithecus*), 31.
 albiventer (*Pteromys*), 363.
 albocinereus (*Semnopithecus*), 41, 42.
 albogularis (*Meles*), 180, 181.
 alboniger (*Sciuropterus*), 367.
 alborufus (*Pteromys*), 365.
 albulus (*Erinaceus*), 219.
 alexandrinus (*Mus*), 406.
 alopec (*Canis*), 153.
 alopec (*Vulpes*), 153.
 alophus (*Hystrix*), 444.
 alpina (*Oorsira*), 230.
 alpina (*Mustela*), 168.
 alpinus (*Cyon*), 144.
 alpinus (*Lagomys*), 450.
 alpinus (*Putorius*), 168.
 Alticola, 430.
 amboinensis (*Hipposiderus*), 290.
 amboinensis (*Phyllorhina*), 290.
 ammon (*Ovis*), 404.
 ammonoides (*Ovis*), 404.
 Aminotragus, 493.
 amplexicaudata (*Cynonycteris*), 261.
 amplexicaudata (*Xantharpyia*), 261.
 anchises (*Semnopithecus*), 27.
 andamanensis (*Macacus*), 18.
 andamanensis (*Mus*), 406.
 andamanensis (*Rhinolophus*), 275.
 andamanensis (*Sus*), 562.
 andersoni (*Herpestes*), 123.
 andersoni (*Vesperugo*), 303.
 annectans (*Pipistrellus*), 316.
 annectens (*Vesperugo*), 316.
 Anteaters, Scaly, 595.
 Antelopes, 517, 521.
 Anthropoides, 3.
 Antilope, 521.
 Anurosorex, 244.
 Aonyx, 181, 188.
 Apes, 4.
 arabica (*Antilope*), 526.
 aranea (*Crocidura*), 243.
 araneus (*Sorex*), 243.
 Arctictis, 117.
 Arctogale, 114.
 Arctoidea, 156.
 arctoides (*Macacus*), 17.
 Arctomyina, 388.
 Arctomys, 388.
 Arctonyx, 178.
 arctus (*Ursus*), 194.
 argali (*Caprovius*), 494.
 argentatus (*Semnopithecus*), 39.
 arianus (*Mus*), 416.
 aristotelis (*Cervus*), 543.
 aristotelis (*Rusa*), 543.
 armiger (*Hipposiderus*), 283.
 armigera (*Phyllorhina*), 283.
 arna (*Bubalus*), 491.
 arnee (*Bos*), 491.
 arni (*Bubalus*), 491.
 Artiodactyla, 479.
 Arvicola, 429.
 aryabertensis (*Lepus*), 450.
 Asellia, 281.
 asiaticus (*Mus*), 406.
 Asinus, 470.

- Ass, Wild, 470.
 assamensis (Anuroso-
 rex), 244.
 assamensis (Macacus),
 15.
 assamensis (Pachyura),
 241.
 assamensis (Pteropus),
 257.
 assamensis (Sciurus),
 381.
 assel (Bibos), 484.
 astutus (Putorius), 171.
 ater (Hipposideros),
 289.
 aterrimus (Sorex), 229.
 Atherura, 445.
 atratus (Hipposideros),
 289.
 atratus (Nycticejus),
 306.
 atratus (Sorex), 240.
 atratus (Vesperugo), 306.
 atridorsalis (Sciurus),
 382.
 attenuatus (Prodelphi-
 nus), 588.
 attenuatus (Steno), 588.
 aurata (Felis), 75.
 auratus (Harpyiocephalus),
 328, 602.
 auratus (Vesperugo),
 335.
 aureobrunnea (Lutra),
 186, 601.
 aureus (Arctomys), 391.
 aureus (Canis), 140.
 aureus (Cervulus), 532.
 aureus (Cervus), 532.
 aureus (Hipposiderus),
 287.
 aureus (Macacus), 21.
 aureus (Paradoxurus),
 110.
 aurita (Manis), 599.
 auritus (Erinaceus),
 219.
 auritus (Lagomys), 457.
 auritus (Plecotus), 297.
 auriventer (Mustela),
 169.
 auropunctata (Mangus-
 ta), 121.
 auropunctatus (Herpes-
 tes), 121.
 auropunctatus birmani-
 cus (Herpestes), 122.
 austenianus (Pipistrel-
 lus), 310.
 australis (Haliore),
 593.
 australis (Miniopertus),
 342.
 Axis, 534.
 axis (Cervus), 546.
 axis major (Cervus), 545.
 axis unicolor (Cervus),
 545.
 bactriana (Alactaga), 392.
 bactrianus (Camelus),
 558.
 bactrianus (Mus), 414.
 bactrianus (Spermophi-
 lus), 391.
 Badgers, 172.
 badius (Mus), 402.
 badius (Rhizomys), 438.
 bahrainja (Cervus), 538.
 Balenidae, 563.
 Balenoptera, 566.
 Bandicoot, 425.
 bandicota (Mus), 425,
 426.
 bandicota (Nesocia), 425.
 banteng (Bos), 489.
 Banting, 489.
 banting (Bibos), 489.
 barang (Lutra), 187, 601.
 Barangia, 181, 187, 601.
 Barasingha, 538.
 Barbastellus, 298.
 barbei (Presbytis), 39.
 barbei (Sciurus), 386.
 barbei (Semnopithecus),
 39.
 barclayana (Nesocia),
 423.
 barclayanus (Mus), 423.
 Barking Deer, 532.
 Bats, 251.
 Bears, 193.
 beavani (Mus), 416.
 beddomei (Crocidura),
 236.
 belangeri (Oladobates),
 210.
 belangeri (Nycticejus),
 320.
 belangeri (Tupaia), 210.
 bengalensis (Arvicola),
 423.
 bengalensis (Canis), 148.
 bengalensis (Cynalopex),
 148.
 bengalensis (Felis), 78.
 bengalensis (Hystrix),
 444.
 bengalensis (Nesocia),
 423.
 bengalensis (Nycticebus),
 44.
 bengalensis (Nyctino-
 mus), 364.
 bengalensis (Sus), 560.
 bengalensis (Viverra),
 100.
 bengalensis (Vulpes),
 148.
 bennetti (Antelope), 526.
 bennetti (Cynogale), 119.
 bennetti (Gazella), 526.
 bennetti (Tragops), 526.
 berdmorei (Mus), 410.
 berdmorei (Myotis), 320.
 berdmorei (Sciurus),
 387.
 Bezoar, 503.
 bezoartica (Antelope),
 521.
 bezoartica (Capra), 538.
 Bhali, 142.
 Bharal, 499.
 Bibos, 483.
 bicolor (Hipposiderus),
 289.
 bicolor (Phyllorhina),
 289.
 bicolor (Sciurus), 373.
 bicolor (Tapirus), 478.
 biddulphi (Lepus), 452.
 bidiana (Crocidura), 238.
 binturong (Arctictis),
 118.
 birmanicus (Herpestes),
 122.
 Bison, 483.
 Blackfish, 577.
 blanfordi (Arvicola), 432.
 blanfordi (Cynopterus),
 265, 602.
 blanfordi (Erinaceus),
 215.
 blanfordi (Microtus),
 432.
 blanfordi (Mus), 411.
 blanfordi (Ovis), 407.
 blanfordi (Sciurus), 379.
 blanfordi (Vesperugo),
 337.
 blanfordi (Vesperugo),
 317.
 blanfordii (Crocidura),
 234.
 blepotis (Miniopertus),
 342.
 Blue bull, 517.
 blythi (Arvicola), 432.
 blythi (Balenoptera),
 567.
 blythi (Capra), 502.
 blythi (Microtus), 432.
 blythianus (Mus), 423.

- blythii (Ceratorhinus), 476.
 blythii (Crociodura), 234.
 blythii (Hipposiderus), 287.
 blythii (Sciurus), 381.
 blythii (Vespertilio), 334.
 Boar, Wild, 560.
 bobac (Arctomys), 388, 389, 390.
 bondar (Paradoxurus), 106.
 booduga (Leggada), 416.
 boops (Megaptera), 568.
 borealis (Balenoptera), 566.
 borealis (Vesperugo), 305.
 Bos, 483.
 Boselaphus, 517.
 Bottle-nose, 573.
 Bovide, 482.
 bowersi (Mus), 410.
 brachyota (Phyllorhina), 287.
 brachyotus (Cynopterus), 264.
 brachysoma (Cynopterus), 264.
 brachyura (Manis), 597.
 brachyura (Nesocia), 423.
 brachyurus (Herpestes), 130.
 brachyurus (Leopardus), 73.
 breviceaudus (Taphozous), 348.
 breviceps (Cogia), 572.
 breviceps (Kogia), 572.
 breviceps (Physctor), 572.
 brevirostris (Orcolla), 578.
 brevirostris (Phocæna), 578.
 brevitarsus (Rhinolophus), 279.
 brodei (Sciurus), 383.
 brookei (Ovis), 495.
 brunnea (Cervoula), 341.
 brunneus (Macacus), 17.
 brunneus (Mus), 406, 408.
 brunneusculus (Mus), 406.
 bubalina (Capricornis), 513.
 bubalinus (Antelope), 513.
 bubalinus (Nemorhædus), 513.
 Bubalus, 483.
 bubalus (Bos), 491.
 bubalus, var. fulvus (Bos), 492.
 Budorcas, 515.
 buduga (Mus), 416.
 Buffalo, 491.
 buffelus (Bos), 491.
 buffelus (Bubalus), 491.
 burrhel (Ovis), 499.
 Cachelot, 571.
 cachhensis (Taphozous), 349.
 cærulea (Crociodura), 236.
 cærulescens (Crociodura), 236.
 cærulescens (Sorex), 236.
 cæruleus (Sorex), 236.
 caffa (Felis), 86.
 Caïng whales, 577.
 Calictis, 119.
 caligata (Felis), 86.
 caliginosus (Vespertilio), 337.
 Calogale, 119.
 Camelus, 558.
 cana (Vulpes), 150.
 canadensis (Cervus), 535, 538.
 cancrivora (Urva), 129.
 caniceps (Pteromys), 365.
 caniceps (Sciuropterus), 365.
 caniceps (Sciurus), 380.
 Canidae, 134.
 canigula (Mustela), 167.
 canigula (Putorius), 167.
 Canis, 135.
 cantori (Taphozous), 348.
 canus (Nycticejus), 315.
 capensis (Delphinus), 588.
 capensis (Sorex), 236.
 Capra, 501.
 Capricornis, 572.
 Caprolagus, 448.
 Caprovis, 493.
 caracal (Felis), 88.
 carbonarius (Macacus), 21.
 carnatica (Vespertilio), 293.
 Carnivora, 49.
 Carponycteris, 265.
 cashmerensis (Cervus), 535.
 cashmirianus (Cervus), 535.
 caspicus (Cervus), 538.
 castaneus (Nycticejus), 320.
 castaneus (Rhizomys), 438.
 catalania (Tursiops), 581.
 Cat-bear, 190.
 cathin (Putorius), 169.
 Catodon, 570.
 catolynx (Felis), 86.
 Cats, 55.
 caucasica (Capra), 502.
 caudata (Corsira), 230.
 caudator (Mus), 409.
 caudatus (Arctomys), 390.
 caudatus (Sorex), 230.
 caudatus (Soriculus), 230.
 Cavicornia, 482.
 cavifrons (Bos), 484.
 cavirostris (Ziphius), 573.
 celidogaster (Felis), 76.
 Cemas, 516.
 cephalopterus (Presbytis), 34.
 cephalopterus (Semnopithecus), 34.
 Ceratorhinus, 476.
 Cercopithecidae, 10.
 Cercopithecina, 10.
 Cervoula, 338.
 cervicapra (Antelope), 521.
 cervicapra (Capra), 521.
 cervicolor (Mus), 416, 417.
 Cervidae, 530.
 Cervina, 531.
 Cervulus, 531.
 Cervus, 534.
 Cetacea, 564.
 ceylanica (Crociodura), 236.
 ceylanicus (Ochryseus), 144.
 ceylanicus (Herpestes), 127.
 ceylonicus (Sciurus), 374.
 ceylonicus (Scotophilus), 312.
 ceylonicus (Vesperugo), 312.
 ceylonus (Mus), 406.
 chanco (Canis), 135.
 charltoni (Felis), 74.
 chaus (Felis), 86.
 chevrieri (Mus), 416.
 Chevrotains, 554.
 chickara (Antelope), 519.

- chickera* (*Tetraceros*), 519.
Chimarrigale, 245.
chinensis (*Felis*), 78.
chinensis (*Tupaia*), 210.
Chiromeles, 353.
Chiropodomys, 403.
Chiroptera, 257.
chiropus (*Mus*), 413, 602.
chiru (*Antilope*), 524.
Chita, 91.
christii (*Gazella*), 526.
Chrysæus, 142.
chrysogaster (*Galidictis*), 158.
chrysogaster (*Moschus*), 552.
chrysogaster (*Presbytes*), 38.
chrysogaster (*Semnopithecus*), 38.
chrysonotus (*Sciurus*), 380.
chrysothrix (*Sciuropterus*), 364.
cineraceus (*Hipposideros*), 289.
cineraceus (*Pteromys*), 361.
cinerascens (*Rhinolophus*), 274.
cinerea (*Oemas*), 576.
cinereus (*Lutra*), 601.
cinereus (*Eupetaurus*), 359.
cinereus (*Nycticebus*), 45.
cinereus (*Rhizomys*), 439.
cinnamomeus (*Mus*), 409.
circumdatus (*Vesperugo*), 312.
Civeta, 95.
civettina (*Viverra*), 98.
civettoides (*Viverra*), 96.
Cladobates, 208.
cœlophyllus (*Rhinolophus*), 272.
Clœps, 290.
coffæus (*Golunda*), 427.
Cogia, 572.
collaris (*Arctonyx*), 178.
collaris (*Erinaceus*), 215.
collaris (*Meles*), 179.
communis (*Barbastellus*), 298.
concolor (*Mus*), 408.
concolor (*Sciurus*), 380.
coromandelianus (*Scotophilus*), 313.
coromandelicus (*Vespertilio*), 313.
coxingi (*Mus*), 412.
craspedotis (*Lepus*), 452.
crassicaudata (*Manis*), 597.
crassipes (*Mus*), 406.
crassispinis (*Hystrix*), 445.
crassus (*Taphozous*), 350.
Oricetina, 428.
Cricetus, 436.
crispus (*Nemorhædus*), 573.
cristata, var. *indica* (*Hystrix*), 442.
cristatus (*Presbytis*), 39.
cristatus (*Sus*), 560.
Crocidura, 231.
crocuta (*Hyæna*), 131.
crossei (*Oeratorhinus*), 476.
crossei (*Rhinoceros*), 476.
crossii (*Paradoxurus*), 108.
cryptura (*Talpa*), 225.
cucullatus (*Semnopithecus*), 33.
cunicularis (*Mus*), 417.
Ouon, 142.
curvostylis (*Cervulus*), 532.
curzonie (*Lagomys*), 457, 458.
cuvieri (*Gerbillus*), 396.
Ouvierius, 566.
cycloceros (*Ovis*), 497.
cyclotis (*Harpyiocephalus*), 326.
cyclotis (*Murina*), 326.
Cynælurus, 90.
Cynoidea, 134.
cynomolgus (*Macacus*), 21.
Cynonycteris, 261.
Cynopterus, 262.
Cyon, 142.
daccaensis (*Mus*), 423.
darjeelingensis (*Mus*), 413.
darjeelingensis (*Plecotus*), 298.
darjeelingensis (*Synotus*), 298.
darjilingensis (*Vespertilio*), 336.
daubentoni (*Vespertilio*), 331.
dauricus (*Lagomys*), 459.
dauvergnei (*Oapra*), 504.
 davidianus (*Putorius*), 171.
dayanus (*Lepus*), 457.
dayi (*Orocidura*), 240, 602.
deccanensis (*Cyon*), 143, 601.
decumanoides (*Mus*), 408.
decumanus (*Mus*), 408.
Deer, 530.
deformis (*Rhinolophus*), 288.
delesserti (*Sciurus*), 385.
Delphinida, 573.
Delphinus, 586.
delphis (*Delphinus*), 587.
densirostris (*Mesoplonodon*), 573.
derbyanus (*Paradoxurus*), 117.
Dermoptera, 248.
desertorum (*Vespertilio*), 333.
diadema (*Hipposiderus*), 283, 284.
diadema (*Phyllorhina*), 285.
diardi (*Felis*), 72.
dichrous (*Arctomys*), 391.
dimidiatus (*Acomys*), 426.
dimidiatus (*Mus*), 426.
dimorpho (*Cervus*), 538.
Dinops, 353.
Dipodidae, 391.
discolor (*Vesperugo*), 305.
dobsoni (*Vespertilio*), 335, 602.
Dogs, Wild, 142.
Dolphin, 587.
dorcas (*Gazella*), 528.
doris (*Delphinus*), 588.
dormeri (*Nycticejus*), 319.
dormeri (*Scotozous*), 319.
dormeri (*Vesperugo*), 319.
dosul (*Leopardus*), 74.
dromedarius (*Camelus*), 558.
dubius (*Mus*), 413.
dubius (*Paradoxurus*), 108.
dugong (*Halicore*), 594.
dugung (*Trichechus*), 594.
dukhunensis (*Cyon*), 143.
dukhunensis (*Rhinolophus*), 287.
dumeticola (*Mus*), 402.

- Duplicidentata, 447.
 dussumieri (Delphinus), 588.
 dussumieri (Sciurus), 384.
 dussumieri (Semnopithecus), 33.
 duvauceli (Cervus), 538.
 duvauceli (Rucervus), 539.
 dybowskii (Cervus), 538.
 Dysopes, 353.
- Echinosorex, 219.
 edeni (Balanoptera), 568.
 Edentata, 525.
 edulis (Pteropus), 259.
 edwardsi (Pteropus), 257.
 edwardsii (Antelope), 515.
 edwardsii (Nemorhedus), 515.
 elaphoides (Cervus), 538.
 elaphus (Cervus), 535.
 eldi (Cervus), 541.
 eldii (Panolia), 541.
 electra (Lagenorhynchus), 580.
 elegans (Nectogale), 247.
 Elephant, 463.
 Elephantidae, 462.
 Elephas, 462.
 Eleutherura, 261.
 elliotanus (Mus), 426.
 ellioti (Golunda), 427.
 ellioti (Herpestes), 126.
 ellioti (Leopardus), 78.
 ellioti (Lutra), 185, 601.
 ellioti (Tupaia), 209.
 Ellobius, 434.
 elphinstonii (Sciurus), 371.
 emarginatus (Nycticejus), 321.
 emarginatus (Scotophilus), 321.
 emarginatus (Vespertilio), 233.
 Emballonura, 344.
 Emballonuridae, 343.
 Emballonurinae, 344.
 entellus (Presbytis), 27.
 entellus (Semnopithecus), 27.
 Eonycteris, 266.
 Equidae, 468.
 equina (Rusa), 543.
 equina (Cervus), 543.
 equioides (Amias), 470.
 Equus, 468.
 Erinaceidae, 212.
- Erinaceinae, 213.
 Erinaceus, 213.
 Ermine, 165.
 erminea (Mustela), 165.
 erminea (Putorius), 165.
 erythræa (Simia), 13.
 erythræus (Sciurus), 377.
 erythrogaster (Sciurus), 377.
 erythrogenys (Rhizomys), 440.
 erythronotus (Mus), 416.
 erythrotis (Felis), 86.
 erythrotis (Lagomys), 458.
 erythrotis (Mus), 420.
 erythrura (Gerbillus), 399.
 etrusca (Crociodura), 241.
 Eudelphinus, 586.
 Eupetaurus, 359.
 Euphysetes, 572.
 europæa (Talpa), 224.
 eurynome (Delphinus), 581.
 euryopilus (Helarctos), 199.
 eustephanus (Cervus), 538.
 Eutheria, 2.
 eversmanni (Putorius), 164.
- falconeri (Ægoceros), 505.
 falconeri (Capra), 505.
 familiaris, var. sumatrensis (Canis), 147.
 fasciatus (Paradoxurus), 109.
 fasciculata (Atherura), 446.
 fœa (Cervulus), 534.
 fœa (Harpyiocephalus), 602.
 Felidae, 53.
 Felis, 55.
 femoralis (Semnopithecus), 42.
 Feroculus, 231.
 ferox (Simia), 16.
 ferrilatus (Cynalopex), 155.
 ferrilatus (Vulpes), 155.
 ferruginea (Tupaia), 210.
 ferrugineus (Herpestes), 123.
 ferrugineus (Sciurus), 375.
 ferrugineus (Sorex), 233.
 ferrum-equinum (Rhinolophus), 278, 279.
 fimbriatus (Sciuropterus), 366.
- finlaysoni (Sciurus), 375.
 finlaysonii (Paradoxurus), 108.
 Fin-whales, 566.
 Fissipedia, 50.
 flaveolus (Nycticejus), 320.
 flavescens (Mus), 406.
 flavescens (Vulpes), 151, 153.
 flavidens (Herpestes), 127.
 flavigula (Martes), 158.
 flavigula (Mustela), 158.
 floweri (Rhinosceros), 475.
 fluminalis (Orcella), 579.
 Flying-Foxes, 255.
 Flying-Lemura, 248.
 Flying-Squirrels, 360.
 foina (Martes), 160.
 foina (Mustela), 160.
 formosa (Murina), 335.
 formosus (Vespertilio), 335.
 Foxes, 147.
 frænatus (Delphinus), 588.
 frederici (Herpestes), 123.
 frithi (Cœlops), 291.
 frontalis (Bos), 487.
 frontalis (Cervus), 541.
 frontalis (Gavæus), 487.
 frontatus (Delphinus), 582.
 frontatus (Steno), 582.
 fulgens (Ælurus), 190.
 fulgens (Rhinolophus), 289.
 fuliginosa (Crociodura), 242.
 fuliginosus (Scotophilus), 342.
 fuliginosus (Sorex), 242.
 fulva (Phyllorhina), 289.
 fulvescens (Herpestes), 127.
 fulvescens (Mus), 409.
 fulvidiventris (Mus), 416.
 fulvidus (Scotophilus), 307.
 fulvidus (Taphozous), 348.
 fulvo-cinerea (Crociodura), 236.
 fulvus (Cricetus), 437.
 fulvus (Hipposideros), 239.
 fumigata (Crociodura), 243.

fumigatus (Sorex), 243.
fusca (Kerivoula), 340.
fuscatus (Tragulus), 557.
fuscicapillus (Ellobius), 435.
fuscicapillus (Sciuropterus), 368.
fuscicaudatus (Scaptonyx), 227.
fuscifrons (Gazella), 526.
fuscocapillus (Georchus), 435.
fuscocarpillus (Myospalax), 435.
fuscocapillus (Pteromys), 368.
fusci (Herpestes), 127.
fusiformis (Delphinus), 580.

gadamu (Delphinus), 583.
gadamu (Sotalia), 583.
Galeopithecidae, 248.
Galeopithecus, 248.
Galerella, 119.
galerita (Phyllorhina), 287.
galeritus (Hipposiderus), 287.
gangetica (Platanista), 590.
gangeticus (Delphinus), 590.
garoensis (Rhinolophus), 277.
Gaur, 484.
gaurus (Bos), 484.
gaurus (Gavæus), 484.
Gavæus, 483.
gavæus (Bos), 487.
gayæus (Bos), 484.
Gayal, 487.
Gazella, 525.
Gazelles, 525.
gedrosianus (Ursus), 197.
geoffroyi (Nyctophilus), 299.
Gerbillinae, 396.
gerbillinus (Mus), 414.
Gerbillus, 396.
germani (Sciurus), 375.
ghoral (Kemas), 516.
Ghorkhar, 470.
Gibbons, 5.
giganteus (Mus), 425.
giganteus (Sciurus), 373.
giganteus (Sorex), 236.
Giraffidae, 529.

gladiator (Delphinus), 576.
gladiator (Orca), 576.
gleadowi (Gerbillus), 400.
gleadowi (Mus), 420.
gliroides (Chiropodomys), 403.
gliroides (Mus), 403.
Glisorcs, 208.
Globicephalus, 577.
Gonta, 501.
Golunda, 427.
golundi (Mus), 427.
goral (Antelope), 516.
goral (Cemas), 516.
goral (Nemorhedus), 516.
gordoni (Sciurus), 377.
gour (Bos), 484.
gracilicauda (Soriculus), 230.
gracilis (Loris), 47.
gracilis (Prionodon), 105.
gracilis (Stenops), 47.
Grampus, 576.
Gravedigger, 177.
grayi (Erinaceus), 215.
grayi (Paradoxurus), 112.
grayiformis (Uon), 144.
grayii (Euphysetes), 572.
griffithii (Nesokia), 422.
griffithii (Sorex), 233.
griffithii (Vulpes), 151.
grisea (Cemas), 516.
griseinanus (Sciurus), 381.
griseus (Grampus), 578.
griseus (Harpyiocephalus), 325.
griseus (Herpestes), 123.
griseus (Lagomys), 458.
grotei (Acanthochærus), 445.
grunniens (Bos), 490.
grunniens (Poëphagus), 490.
Guavera, 485.
guentheri (Microtus), 433.
guentheri (Trichys), 447.
guttata (Felis), 91.
gutturosa (Gazella), 528.
gwatkinsi (Martes), 158.
Gymnura, 219.
gymnura (Viverra), 220.
Gymnurinae, 219.

Halicore, 593.
Hamsters, 436.

Hapalomys, 461.
hardwickei (Hemigale), 117.
hardwickei (Nesocia), 422, 423.
hardwickii (Cerivoula), 340.
hardwickii (Mus), 422.
hardwickii (Rhinopoma), 351.
Hares, 448.
harpia (Vespertilio), 325.
harpyia (Harpyiocephalus), 325.
Harpyiocephalus, 323.
hasselti (Vespertilio), 330.
hazenna (Antelope), 526.
heathii (Nycticejus), 320.
Hedgehogs, 213.
Helarctos, 193.
Helictis, 172.
hemachelanus (Arctomys), 389, 390.
Hemiechinus, 214.
hemionus (Asinus), 470.
hemippus (Equus), 470.
Hemitragus, 508.
hemprichi (Otonycteris), 300.
hermaphroditus (Paradoxurus), 106, 108.
Herpestes, 119.
Herpestinae, 119.
herschellii (Felis), 78.
Hesperoptenus, 303.
heterocervus (Rusa), 543.
heterodon (Sorex), 234.
himalaica (Crociodura), 245.
himalaicus (Canis), 153.
himalayana (Capra), 503.
himalayanus (Arctomys), 388.
himalayanus (Felis), 76.
himalayica (Chimarrogale), 245.
himalayicus (Crossopus), 245.
hippelaphus (Cervus), 543.
hippelaphus (Rusa), 543.
Hippopotamidae, 563.
Hippopotamus, 563.
Hipposiderinae, 280.
Hipposiderus, 281.
hipposiderus (Rhinolophus), 277.
hippurus (Sciurus), 377.
Hircus, 501.

- hirsutirostris* (*Hystrix*), 442.
hirsutus (*Mus*), 427.
hirsutus (*Paradoxurus*), 106, 108.
hispidus (*Caprolagus*), 454.
hispidus (*Lepus*), 454.
hodgsoni (*Arctomys*), 389.
hodgsoni (*Crocidura*), 240.
hodgsoni (*Hystrix*), 444.
hodgsoni (*Lagomys*), 456.
hodgsoni (*Mustela*), 166, 167.
hodgsoni (*Ovis*), 494.
hodgsoni (*Pantholops*), 524.
hodgsoni (*Sorex*), 240.
hodgsonii (*Antelope*), 524.
hodgsonii (*Kemas*), 524.
hodgsonii (*Vulpes*), 148.
Hog-badger, 178.
Hog-deer, 549.
holosericeus (*Sorex*), 230.
Hominidæ, 4.
homochrous (*Plecotus*), 207.
homourus (*Mus*), 413.
homourus (*Sorex*), 230.
hoolock (*Hylobates*), 5, 601.
horeites (*Mus*), 406.
horsfieldi (*Crocidura*), 242.
horsfieldi (*Megaderma*), 294.
horsfieldi (*Sorex*), 242.
horsfieldii (*Leopardus*), 78.
horsfieldii (*Mustela*), 116.
horsfieldii (*Pteromys*), 367.
horsfieldii (*Sciuropterus*), 367.
humei (*Mus*), 423.
humeralis (*Mustela*), 166.
hurrianæ (*Gerbillus*), 398.
huttoni (*Felis*), 85.
huttoni (*Nesokia*), 422.
huttonii (*Harpyiocephalus*), 327.
Hyæna, 131.
Hyænidæ, 131.
Hyelaphus, 534.
Hylobates, 5.
hylocrius (*Capra*), 511.
hylocrius (*Hemitragus*), 511.
hylocrius (*Kemas*), 511.
Hylogale, 208.
Hylomys, 219, 602.
hyperythrus (*Sciurus*), 382.
hypoleucos (*Presbytis*), 33.
hypoleucus (*Semnopithecus*), 33.
hypsibius (*Lepus*), 453.
Hypudæus, 429.
Hyracoidæ, 461.
Hystricidæ, 441.
Hystricomorpha, 358.
Hystrix, 441.
Ibex, 501.
ibex (*Capra*), 503.
Ichneumon, 119.
Ictides, 117.
imbricatus (*Vespertilio*), 313.
inauritus (*Ursitaxus*), 176.
inconspicua (*Felis*), 85.
indi (*Platanista*), 590.
indica (*Alactaga*), 392.
indica (*Arvicola*), 422.
indica (*Balenoptera*), 567.
indica (*Lutra*), 182.
indica (*Megaptera*), 568.
indica (*Mellivora*), 176.
indica (*Meminna*), 555.
indica (*Nesokia*), 422, 423.
indica (*Spalacomys*), 422.
indica (*Viverra*), 100.
indicus (*Asinus*), 470.
indicus (*Bos*), 483.
indicus (*Elephas*), 463.
indicus (*Funambulus*), 383.
indicus (*Gerbillus*), 396, 398.
indicus (*Globicephalus*), 577.
indicus (*Halicore*), 594.
indicus (*Mus*), 396, 406, 422, 423, 425.
indicus (*Oxygoys*), 140.
indicus (*Pholidotus*), 507.
indicus (*Rhinoceros*), 472.
indicus (*Sacalis*), 140.
indicus (*Sciurus*), 371.
indicus (*Sorex*), 236.
indicus (*Sus*), 560.
indicus (*Tapirus*), 478.
indicus (*Ursus*), 176.
indicus (*Vesperugo*), 312.
indigitata (*Lutra*), 187.
inermis (*Rhinoceros*), 475.
infralineatus (*Mus*), 406.
inornatus (*Pteromys*), 463.
inornatus (*Ursus*), 201.
Insectivora, 206.
Insectivora vera, 207.
insignis (*Rhinolophus*), 288.
intermedius (*Ellobius*), 435.
Inus, 11.
iodes (*Tetracerus*), 520.
irbis (*Felis*), 71.
irus (*Macacus*), 21.
isabellina (*Felis*), 89.
isabellinus (*Cricetus*), 437.
isabellinus (*Nycticejus*), 317.
isabellinus (*Ursus*), 194.
isonyx (*Arctonyx*), 179.
Jackal, 140.
jacquemontii (*Felis*), 86.
Jald-hasti, 563.
jarai (*Cervus*), 543.
jaraya (*Rusa*), 543.
javanensis (*Felis*), 78.
javanica (*Hystrix*), 445.
javanica (*Manis*), 599.
javanica (*Nycteria*), 295.
javanica (*Tupaia*), 212.
javanicus (*Canis*), 147.
javanicus (*Herpestes*), 130.
javanicus (*Moschus*), 556, 557.
javanicus (*Nycticebus*), 46.
javanicus (*Rhinoceros*), 474.
javanicus (*Tragulus*), 556, 557.
javensis (*Felis*), 78.
jemlahica (*Capra*), 509.
jemlaicus (*Hemitragus*), 509.
Jerboas, 391.
jerdoni (*Capra*), 505.
jerdoni (*Erinaceus*), 216.

- jerdoni (Felis), 78.
 jerdoni (Leggada), 411.
 jerdoni (Mus), 411.
 jerdoni (Paradoxurus), 111.
 jerdonii (Herpestes), 126.
 jharal (Capra), 509.
 jharal (Hemitragus), 509.
 johni (Semnopithecus), 33.
 johnii (Presbytis), 33.
 johorensis (Nyctinomus), 355.
 joongshaiensis (Lepus), 451.
 jubata (Felis), 91.
 jubatus (Cynælurus), 91.
 jubatus (Presbytis), 33.
 jubatus (Semnopithecus), 33.
 kachhensis (Taphozous), 349.
 kakhyenensis (Mus), 413.
 kanchil (Moschus), 556.
 kanchil (Tragulus), 556.
 kandianus (Mus), 406.
 kandianus (Sorex), 233.
 karelini (Ovis), 496.
 Kashmir Stag, 535.
 kathia (Mustela), 169.
 kelaarti (Crocidura), 244.
 kelaarti (Sciurus), 383.
 kelaarti (Semnopithecus), 34.
 kelaarti (Sorex), 244.
 kelaarti (Pteropus), 257.
 Kemas, 516.
 kemas (Antelope), 524.
 kephalopterus (Cercopithecus), 34.
 keraudrenii (Sciurus), 375.
 Kerivoula, 338.
 Kiang, 470.
 kiang (Equus), 470.
 Killer, 576.
 kingiana (Crocidura), 242.
 Kogia, 572.
 kok (Mus), 423.
 kok (Nesokia), 423.
 kokree (Canis), 148.
 kol bhālū, 142.
 kuhli (Nycticejus), 320.
 kuhli (Vesperugo), 315.
 kuhlii (Scotophilus), 320.
 kurrachiensis (Neomeris), 576.
 kutas (Felis), 86.
 labiata (Vesperugo), 308.
 labiatus (Ursus), 201.
 ladacensis (Lagomys), 458.
 Lagenorhynchus, 579.
 Lagomyida, 455.
 Lagomys, 455.
 Lama, 558.
 laneus (Cynælurus), 90.
 laniger (Lupus), 135.
 laniger (Paradoxurus), 114.
 lankadiva (Hipposiderus), 283, 285.
 lanuginosus (Mus), 419.
 lar (Hylobates), 7.
 larvata (Paradoxurus), 114.
 larvata (Phyllorhina), 288.
 larvatus (Hipposiderus), 288.
 larvatus (Putorius), 163.
 larvatus (Rhinolophus), 273.
 lasiotis (Ceratotherium), 476.
 lasiotis (Rhinoceros), 476.
 lasiurus (Platanthomya), 394.
 lasyura (Noctilina), 325.
 layardi (Sciuropterus), 368.
 layardi (Sciurus), 385.
 leachii (Pteromys), 367.
 Leggada, 419.
 leialori (Scotophilus), 309.
 leisleri (Vesperugo), 309.
 Lemuroidea, 43.
 Lemuroidea, 43.
 Lemurs, 43.
 Lemurs, Flying, 248.
 lentiginosa (Sotalia), 584.
 lentiginosus (Delphinus), 584.
 lentiginosus (Steno), 584.
 leo (Felis), 56.
 leoninus (Inuus), 18.
 leoninus (Macacus), 18.
 Leopard, 67.
 Leopard, hunting, 91.
 leopardus (Felis), 67.
 lepida (Leggada), 416.
 lepidus (Mus), 416.
 lepidus (Pipistrellus), 315.
 lepidus (Rhinolophus), 277.
 lepidus (Sciuropterus), 368.
 Leporidae, 447.
 leptonyx (Aonyx), 187.
 leptonyx (Lutra), 187.
 601.
 leptophylla (Phyllorhina), 284.
 leptophyllum (Hipposiderus), 284.
 leptura (Manis), 599.
 Lepus, 448.
 leschenaultii (Cervus), 543.
 leschenaultii (Pteropus), 261.
 leucoccephalus (Pteropus), 257.
 leucodon (Sorex), 243.
 leucogaster (Harpiocephalus), 327.
 leucogaster (Moschus), 552.
 leucogaster (Murina), 327.
 leucogenys (Crocidura), 239.
 leucogenys (Hylobates), 9.
 leucolachnæ (Martes), 160.
 leucolamus (Meles), 180.
 leucoprymnus (Cercopithecus), 34.
 leucops (Sorex), 230.
 leucopus (Vulpes), 151.
 leucotis (Arctogale), 115.
 leucotis (Paradoxurus), 115.
 leucotis (Vesperugo), 315.
 leucura (Hystrix), 442.
 leucura (Manis), 599.
 leucura (Parascaptor), 226.
 leucura (Talpa), 226.
 leucura (Taxidea), 180.
 leucurus (Pangolinus), 599.
 leucurus (Phaiomys), 432.
 Linsang, 102.
 Lion, 56.
 lobatus (Scotophilus), 315.
 lobipes (Vespertilio), 337.

- loceria* (*Sciurus*), 376.
locroides (*Sciurus*), 381.
lokriah (*Sciurus*), 376.
lokroides (*Sciurus*), 381.
longicauda (*Hystrix*), 444, 445.
longicaudatus (*Hapalomyis*), 401.
longimanus (*Taphozous*), 348.
longipes (*Vespertilio*), 331.
longirostris (*Delphinus*), 588, 589.
Loris, 47.
luctus (*Rhinolophus*), 270.
luehdorfi (*Cervus*), 538.
Lupus, 135.
lupus (*Canis*), 135, 137.
luteus (*Nycticejus*), 320.
Lutra, 181.
Lutrinae, 181.
lynx (*Felis*), 89.
lyra (*Megaderma*), 203.

Macacus, 11.
macarthius (*Oynictis*), 127.
macarthius (*Herpestes*), 127.
macarthius (*Onychogale*), 127.
maccllelandi (*Sciurus*), 386.
maccllelandi, var. *swinhoei* (*Sciurus*), 386.
macloayi (*Euphysetes*), 572.
macracanthus (*Erinaceus*), 217.
macrocelis (*Felis*), 72.
macroceloides (*Felis*), 72.
macrocephalus (*Catodon*), 571.
macrocephalus (*Physeter*), 571.
macrocerus (*Bos*), 492.
macrodus (*Lutra*), 601.
Macroglossus, 265.
macropus (*Oroidura*), 237.
macropus (*Feroculus*), 237.
macropus (*Mus*), 426.
macropus (*Sorex*), 237.
macropus (*Vespertilio*), 331.
macrotis (*Oroidura*), 241.

macrotis (*Lagomys*), 457.
macrotis (*Rhinolophus*), 276.
macrotus (*Lepus*), 450.
macroura (*Hystrix*), 446.
macrura (*Atherura*), 446.
macrura (*Talpa*), 224.
macruroides (*Sciurus*), 373.
macrurus (*Sciurus*), 374.
macrurus (*Sorex*), 231.
macrurus (*Soriculus*), 231.
maculata (*Axis*), 547.
maculiventer (*Delphinus*), 582, 585.
maculiventer (*Steno*), 585.
maculosus (*Prionodon*), 104.
maderaspatanus (*Scotoophilus*), 310.
magnificus (*Pteromys*), 363, 364.
major (*Axis*), 547.
malabarica (*Hystrix*), 442.
malabaricus (*Mus*), 425.
malabaricus (*Sciurus*), 371.
malaccensis (*Herpestes*), 123.
malaccensis (*Viverra*), 100.
malaccensis (*Viverricula*), 100.
malayanus (*Delphinus*), 588.
malayanus (*Helarctos*), 199.
malayanus (*Prodelphinus*), 588.
malayanus (*Tapirus*), 478.
malayanus (*Ursus*), 199.
Manatidae, 591.
mandarinus (*Microtus*), 433.
manei (*Mus*), 413.
Mangusta, 119.
Manidae, 595.
Manis, 595.
mantchuricus (*Cervus*), 538.
manul (*Felis*), 83.
maral (*Cervus*), 538.
marginatus (*Cynopterus*), 263.

marginatus, var. *andamanensis* (*Cynopterus*), 264.
Markhor, 505.
marmorata (*Felis*), 74.
Marmots, 388.
Martens, 158.
Martes, 157.
martes (*Mustela*), 161.
masoni (*Phyllorhina*), 285.
maurus (*Macacus*), 18.
maurus (*Vesperugo*), 310.
maximus (*Elephas*), 463.
maximus (*Sciurus*), 371.
media (*Crocidura*), 236.
medius (*Pteropus*), 257.
megaceros (*Capra*), 505.
megaceros (*Hircus*), 505.
Megachiroptera, 255.
Megaderma, 292.
megalopus (*Vespertilio*), 332.
megalotis (*Erinaceus*), 216.
Megaptora, 568.
megaspila (*Viverra*), 99.
melanodon (*Sorex*), 241.
melanogaster (*Arvicola*), 434.
melanogaster (*Canis*), 154.
melanogaster (*Microtus*), 434.
melanoleucus (*Elurops*), 205.
melanopogon (*Taphozous*), 347.
melanopterus (*Pteromys*), 365.
melanostoma (*Lagomys*), 458.
melanotus (*Papio*), 17.
melanotus (*Pteropus*), 260.
melanurus (*Viverra*), 96.
melas (*Cervus*), 532.
melas (*Delphinus*), 575.
melas (*Felis*), 69.
Melinae, 172.
Mellivora, 175.
Melogale, 172.
meltada (*Golunda*), 419.
Melursus, 200.
Meminna, 554.
meminna (*Moschus*), 555.
meninna (*Tragulus*), 555.
Meriones, 396.
Mesobema, 119.

- mettada (Mus), 419.
 Mice, 406.
 Microchiroptera, 287.
 micronyx (Sorex), 240.
 microphyllum (Rhino-
 poma), 351.
 micropus (Erinaceus), 218.
 micropus (Phyllorhina),
 290.
 micropus (Vesperugo),
 313.
 Microtus, 429.
 micura (Talpa), 225.
 milne-edwardsii (Capri-
 cornis), 515.
 minima (Curponycteris),
 265.
 mininus (Macroglossus),
 265.
 Miniopertus, 341.
 minor (Axis), 547.
 minor (Rhinolophus),
 276.
 minor (Rhizomys), 438.
 minuta (Felis), 78.
 minutus (Sorex), 234.
 Mithan, 487.
 mitratus (Rhinolophus),
 273.
 molagan (Delphinapter-
 us), 575.
 Mole-rats, 421.
 Moles, 223.
 Molossinae, 352.
 Monkeys, 10, 25.
 montana (Crociodura),
 234.
 montana (Ovis), 497.
 montanus (Paradoxurus),
 111.
 montanus (Sorex), 233.
 montanus (Vulpes), 153.
 monticola (Lutra), 185.
 monticolus (Herpestes),
 126.
 moormensis (Felis), 75.
 mops (Nytinomus), 355.
 mordax (Vesperugo), 310.
 morungensis (Mus), 423.
 moschata (Helictis), 175.
 moschatus (Cervulus),
 532.
 moschiferus (Moschus),
 552.
 Moschinae, 551.
 Moschus, 551.
 mouhoti (Sciurus), 387.
 moupimensis (Putorius),
 171.
 moupinensis (Vespertilio),
 337.
 Mouse Deer, 555.
 Mouse-Hares, 455.
 muelleri (Hystrix), 445.
 mungo (Herpestes), 123.
 Mungooses, 119.
 Mungos, 119.
 mungos (Mangusta), 123.
 muntjac (Cervulus), 532.
 Muntjacus, 531.
 muntjacus (Stylocerus),
 532.
 muntjak (Cervus), 532.
 muntjak (Styloceros),
 532.
 muricola (Vespertilio),
 337.
 Muridae, 393.
 Murina, 323.
 murina (Crociodura), 233.
 Murinae, 400.
 murinoides (Vespertilio),
 335.
 murinus (Dysopes), 354.
 murinus (Hipposideros),
 289.
 murinus (Myotis), 334.
 murinus (Sorex), 233,
 236.
 murinus (Vespertilio),
 334.
 Mus, 404.
 musanga (Paradoxurus),
 106, 108.
 musangoides (Paradoxu-
 rus), 108.
 muscatensis (Gazella),
 528.
 musculus (Balanoptera),
 567.
 musculus (Mus), 413.
 Musk-deer, 552.
 Mustela, 157, 162.
 Mustelidae, 156.
 Mustelinae, 157.
 myiodes (Sorex), 243.
 Myiomorpha, 357.
 Myospalax, 434.
 myosurus (Sorex), 233,
 236.
 myotherix (Mus), 427.
 Myotis, 300, 328.
 mystacinus (Vespertilio),
 330.
 Mystacoceti, 565.
 mysticetus (Balaeno-
 ptera), 566.
 nahoar (Ovis), 499.
 nahoar (Pseudois), 499.
 nahura (Ovis), 499.
 nair (Lutra), 182, 185.
 nanus (Gerbillus), 399.
 napu (Moschus), 557.
 napu (Tragulus), 557.
 narayanus (Cervus), 538.
 nasalis (Rhinoceros), 475.
 nasutus (Vesperugo), 304.
 nayaur (Ovis), 494, 499.
 nebulosa (Felis), 72.
 Nectogale, 246.
 nemestrinus (Inuus), 20.
 nemestrinus (Macacus),
 20.
 nemoralis (Mus), 406.
 Nemorhadus, 512, 516.
 nemorivaga (Nesocia),
 426.
 nemorivagus (Mus), 426.
 nemorivagus (Sorex), 233.
 Neodon, 429.
 Neomeris, 574.
 nepalensis (Barangia),
 186, 601.
 nepalensis (Rusa), 543.
 Nesocia, 421.
 Nesokia, 421.
 newera (Golunda), 427.
 newera ellia (Corsira),
 237.
 nicobarensis (Hipposide-
 rus), 286.
 nicobarensis (Phyllo-
 rhina), 286.
 nicobarica (Tupaia), 212.
 nicobaricus (Cladobates),
 212.
 nicobaricus (Pteropus),
 260.
 niger (Canis), 135.
 niger (Oeratorhinus), 476.
 niger (Cervus), 543.
 niger (Paradoxurus), 106.
 niger (Sorex), 233.
 nigrescens (Corsira), 229.
 nigrescens (Felis), 75.
 nigrescens (Soriculus),
 229.
 nigricollis (Lepus), 449.
 nigrifrons (Paradoxurus),
 108.
 nigripectus (Felis), 83.
 nilagircus (Mus), 402.
 Nilgai, 517.
 nilgircia (Crociodura),
 241.
 nilssoni (Vesperugo), 305.
 nipalensis (Felis), 78.
 nipalensis (Gulo), 173.
 nipalensis (Helictis), 173,
 174.
 nipalensis (Herpestes),
 121.

- nipalensis* (*Lagomys*), 456.
nipalensis (*Musculus*), 413.
nipalensis (*Paradoxurus*), 112.
nipalensis (*Vespertilio*), 333.
nipalensis (*Vulpes*), 153.
nitidofulva (*Crocidura*), 241.
nitidulus (*Mus*), 415.
nitidus (*Mus*), 406.
nitidus (*Pteromys*), 365.
nitscheri (*Lepus*), 454.
niveiventer (*Mus*), 412.
nicolicus (*Nycticejus*), 322.
nobilis (*Hipposideros*), 285.
nobilis (*Sciuropterus*), 364.
noctula (*Vesperugo*), 308.
Noctulinia, 300.
nudipalpebra (*Cervus*), 346.
nudipes (*Putorius*), 171.
nudipes (*Sorex*), 241.
nudiventris (*Erinaceus*), 218.
nudiventris, subsp. *kach-hensis* (*Taphozous*), 349.
Nycteridae, 292.
Nycteria, 295.
Nycticebus, 44.
Nycticejus, 318.
Nyctinomus, 353.
Nyctocleptes, 438.
Nyctophilus geoffroyi, 299.
Nyctophilus timoriensis, 299.
nyula (*Mangusta*), 123.
obscurum (*Lagenorhynchus*), 580.
obscurus (*Arctonyx*), 180.
obscurus (*Delphinus*), 580.
obscurus (*Presbytis*), 41.
obscurus (*Prodelphinus*), 580.
obscurus (*Semnopithecus*), 41.
ochraceus (*Ailurus*), 190.
ocreatus (*Macacus*), 18.
octomammis (*Mus*), 411.
Odontoceti, 569.
ogilbii (*Felis*), 78.
oinops (*Macacus*), 13.
oiostolus (*Lepus*), 452.
oleracea (*Vandeleuria*), 402.
oleraceus (*Mus*), 402.
oliguris (*Sorex*), 239.
onager (*Asinus*), 470.
onager (*Equus*), 470.
Onychogale, 110.
oral (*Pteromys*), 361.
Orca, 576.
orca (*Delphinus*), 576.
Orcella, 578.
orientalis (*Gulo*), 173.
orientalis (*Helictis*), 173, 174.
orientalis (*Viverra*), 96.
ornata (*Felis*), 84.
ornatus (*Nycticejus*), 322.
ornatus (*Scotophilus*), 322.
oryzus (*Axis*), 549.
Osmetectis, 119.
Otonycteris, 299.
Otters, 181.
Ounce, 71.
Ovis, 493.
Oxygous, 135.
paccerois (*Tetracerus*), 520.
pachyomus (*Scotophilus*), 303.
pachyotis (*Vesperugo*), 307.
pachypus (*Vesperugo*), 307.
Pachysoma, 262.
Pachyura, 231.
Paguma, 105, 114.
pallasii (*Platyschista*), 106.
pallida (*Kerivoula*), 335.
pallida (*Viverra*), 100.
pallidiventris (*Vespertilio*), 314, 333.
pallidus (*Herpestes*), 176.
pallidus (*Nycticejus*), 322.
pallidus (*Scotophilus*), 322.
pallipes (*Oanias*), 137.
pallipes (*Herpestes*), 121.
pallipes (*Lepus*), 452, 453.
palmarum (*Mus*), 406.
palmarum (*Sciurus*), 383.
Palm-Oivets, 105.
Pangolins, 565.
Panolia, 534.
Panther, 67.
Pantholops, 524.
papillosa (*Cerivoula*), 341.
Paradoxurus, 105.
Parascaptor, 223.
pardipolor (*Prionodon*), 103.
pardochrous (*Felis*), 78.
pardus (*Felis*), 87.
parvipes (*Myotis*), 313.
Pazen, 503.
pealiana (*Crocidura*), 234.
pearsoni (*Rhinolophus*), 273.
pearsoni (*Sciuropterus*), 369.
pearsonii (*Lasiurus*), 325.
Pecora, 481.
peguana (*Tupaia*), 210.
peguensis (*Hylomys*), 222.
peguensis (*Lepus*), 451.
peguensis (*Mus*), 403.
pelandoc (*Tragulus*), 557.
Pelomys, 427.
pelops (*Inuus*), 15.
pelops (*Macacus*), 15.
pembertonii (*Sciurus*), 386.
penicillatus (*Chiropodomys*), 403.
penicillatus (*Sciurus*), 383.
pennantii (*Axis*), 543.
pennantii (*Paradoxurus*), 106.
pentadactyla (*Manis*), 597.
perchal (*Mus*), 425.
Perissodactyla, 467.
perniger (*Delphinus*), 583.
perniger (*Rhinolophus*), 270.
perniger (*Steno*), 583.
perniger (*Tursiops*), 583.
pernyi (*Sciurus*), 377.
perrotteti (*Crocidura*), 241.
perrotteti (*Sorex*), 241.
persica (*Vulpes*), 152.
persicus (*Herpestes*), 121.
persicus (*Trionops*), 280.
personata (*Helictis*), 174.
personata (*Melogale*), 174.
petaurista (*Pteromys*), 341, 365.
petersi (*Rhinolophus*), 275.
phæus (*Oriocetus*), 436.

- Phaiomys, 429.
 phayrei (Presbytis), 39.
 phayrei (Sciuropterus), 368.
 phayrei (Sciurus), 379.
 phayrei (Semnopithecus), 39.
 Pheal, 142.
 philippensis (Pteromys), 361.
 Phion, 142.
 Phnew, 142.
 Phocæna, 574.
 phocœnoides (Delphin[†] apterus), 574.
 phocœnoides (Neomeris), 574.
 phocœnoides (Phocæna), 574.
 Phyllorhina, 281.
 Physalus, 566.
 Physeter, 570.
 Physeteridæ, 570.
 Physeterinae, 570.
 piceus (Sciurus), 377.
 picta (Antilope), 517.
 picta (Cervivola), 339.
 picta (Portax), 518.
 picticaudata (Gazella), 529.
 picticaudata (Procapra), 529.
 pictus (Erinaceus), 217.
 Pigs, 559.
 pileatus (Macacus), 24.
 pileatus (Presbytis), 37.
 pileatus (Semnopithecus), 37.
 pilorides (Sorex), 236.
 Pilot whales, 577.
 pipistrellus (Myotis), 314.
 pipistrellus (Vesperugo), 314.
 piscator (Ursus), 205.
 planiceps (Felis), 83.
 Platacanthomyia, 394.
 Platacanthomyia, 394.
 Platanista, 589.
 Platanistidæ, 589.
 platycephalus (Chimarrogale), 246.
 platyceros (Panolia), 541.
 Platysechista, 105.
 platythrix (Leggada), 418.
 platythrix (Mus), 418.
 Plecotus, 297.
 Plesiometaearpi, f 31.
 plicatus (Nyctinomus), 354.
 plumbea (Sotalia), 583.
 plumbeus (Delphinus), 583.
 plumbeus (Steno), 583.
 plurimammis[†] (Mus), 423.
 Poëphagus, 483.
 poëphagus (Bison), 490.
 poëphagus (Bos), 490.
 Polecata, 162.
 poli (Ovis), 496.
 polyodon (Asinus), 470.
 pomegra (Delphinus), 587.
 porcinus (Axis), 549.
 porcinus (Cervus), 549.
 porcinus (Hyelaphus), 549.
 Porcula, 559.
 Porcupines, 441.
 Porpoise, Indian, 574.
 Portax, 517.
 Potamochoerus, 560.
 potenziani (Semnopithecus), 38.
 povensis (Mus), 402.
 prehensilis (Paradoxurus), 108, 115.
 Presbytis, 25.
 priamus (Presbytis), 31.
 priamus (Semnopithecus), 31.
 primævus (Canis), 143.
 primævus (Cuon), 144, 147.
 Primates, 3.
 Prionodon, 102.
 problematicus (Macacus), 15.
 Proboscidea, 462.
 Procapra, 525.
 Procervus, 534.
 Prochilus, 200.
 proclivus (Nemorhædus), 513.
 Procyonidæ, 189.
 Prodelphinus, 586.
 providens (Mus), 423.
 Prox, 531.
 pruinosis (Rhizomys), 439.
 pruinosis (Ursus), 134.
 Pseudocervus, 534.
 Pseudois, 493.
 Pteromys, 360.
 Pteropodidæ, 255.
 Pteropus, 255.
 pulcher (Taphozous), 360.
 punctatissimus (Macroxus), 377.
 punctatus (Pteromys), 365.
 purpureus (Sciurus), 371.
 pusillus (Miniopterus), 342.
 pusillus (Rhinolophus), 277.
 pusillus (Vulpes), 151.
 putorius (Putorius), 164.
 Putorius, 162.
 pyctorhis (Mus), 422.
 pygerytkrus (Sciurus), 379.
 pygmaoides (Crociodura), 240.
 pygmaeus (Mus), 420.
 pygmaeus (Sorex), 240.
 Pygmura, 244.
 pyrrivorus (Pteropus), 261.
 quadricornis (Antilope), 519.
 quadricornis (Tetracerus), 519.
 quadrimammis (Capra), 500.
 quadrimammis (Homitragus), 509.
 quadriscipus (Paradoxurus), 109.
 quinquelineatus (Paradoxurus), 108.
 quinquestriatus (Sciurus), 378.
 Raccoons, 189.
 radiatus (Macacus), 23.
 rafflesii (Gymnura), 220.
 rama (Mus), 413.
 ranmanika (Rhinolophus), 274.
 rasse (Viverra), 100.
 ratel (Mollivora), 176.
 Ratels, 175.
 Rats, 404.
 rattoides (Mus), 406.
 rattus (Mus), 406.
 rattus rufescens (Mus), 406.
 ratwa (Cervus), 532.
 reevesi (Cervulus), 533.
 retusa (Crociodura), 242.
 rheso-similis (Macacus), 15.
 rhesus (Inuus), 13.
 rhesus (Macacus), 13.
 Rhinoceros, 471.
 Rhinocerotidæ, 471.
 Rhinolphidæ, 267.

- Rhinolophus*, 268.
Rhinolophus, 268.
Rhinopoma, 350.
Rhizomys, 438.
Rib-faced Deer, 532.
risia (*Damalis*), 517.
robustus (*Arctomys*), 391.
robustus (*Mus*), 406.
Rodentia, 356.
roseiventris (*Delphinus*), 538.
rostrata (*Balaenoptera*), 566.
rostratus (*Delphinorhynchus*), 582.
rostratus (*Delphinus*), 582.
rostratus (*Hyperoodon*), 573.
rostratus (*Steno*), 582.
rouxii (*Rhinolophus*), 274.
roylei (*Arvicola*), 430.
royloi (*Lagomys*), 456.
royloi (*Microtus*), 430.
rubicunda (*Oroidura*), 239.
rubida (*Capricornis*), 514.
rubidus (*Paradoxurus*), 114.
rubidus (*Rhinolophus*), 274.
rubiginosa (*Felis*), 81.
rubiginosus (*Crossarchus*), 126.
rubiginosus (*Herpestes*), 126.
rubricosa (*Oroidura*), 242.
Rucervus, 534.
rufescens (*Canis*), 148.
rufescens (*Lagomys*), 456.
rufescens (*Macacus*), 18.
rufescens (*Mus*), 406.
ruficaudatus (*Lepus*), 450.
rufigenis (*Sciurus*), 376.
Rusa, 534.
rusculus (*Sorex*), 243.
rutilans (*Canis*), 147.
rutilans (*Cyon*), 144.
rutilans (*Cyon*), 147.
rutilus (*Lagomys*), 458.

Saccalius, 135.
saccolemus (*Taphozous*), 350.
saccolaimus (*Taphozous*), 350.

sagitta (*Sciuropterus*), 367.
sakeen (*Capra*), 503.
sakin (*Ibex*), 503.
salvania (*Porcula*), 563.
salvanus (*Sus*), 563.
Sámbar, 543.
sarmatica (*Mustela*), 164.
sarmaticus (*Putorius*), 164.
saturatior (*Sorex*), 233.
saturatus (*Moschus*), 552.
savii (*Vesperugo*), 311.
scherzeri (*Cynopterus*), 264.
schistacea (*Megaderma*), 293.
schistaceus (*Procyon*), 30.
schistaceus (*Semnopithecus*), 30.
schlogeli (*Balaenoptera*), 567.
schomburgki (*Cervus*), 540.
schreibersi (*Miniopterus*), 342.
Sciirtetes, 391.
Sciuridae, 358.
Sciurinae, 359.
Sciuromorpha, 357.
Sciuropterus, 366.
Sciurus, 369.
Scotophilus, 300, 318.
serofi (*Sus*), 560.
scullyi (*Nesocia*), 423.
sechellensis (*Dioplodon*), 573.
semicaudata (*Emballonura*), 345.
semitorquatus (*Herpestes*), 130.
Semnopithecinae, 25.
Semnopithecus, 25.
senex (*Cercopithecus*), 35.
senex (*Sciuropterus*), 365.
senex (*Semnopithecus*), 35.
serotinus (*Scotophilus*), 303.
serotinus (*Vesperugo*), 303.
Serow, 513.
serpentarius (*Sorex*), 233.
servalina (*Felis*), 84.
setifer (*Mus*), 426.
Shá, 497.
shawiana (*Felis*), 85.
Sheep, Wild, 493.
Shrews, 22.
Siamang, 9.

siamensis (*Semnopithecus*), 41, 42.
sibbaldi (*Balaenoptera*), 567.
Sibbaldius, 566.
sibirica (*Capra*), 503.
sibirica (*Ibex*), 503.
sibirica (*Mustela*), 172.
sifanicus (*Moschus*), 552.
sika (*Cervus*), 538.
sikimensis (*Microtus*), 433.
sikimensis (*Neodon*), 433.
sikkimensis (*Sorex*), 229.
silenus (*Inuus*), 16.
silenus (*Macacus*), 16.
siligorensis (*Vespertilio*), 336.
Simiidae, 4.
similis (*Macroxus*), 381.
simplicidentata, 357.
sinung (*Lutra*), 185.
simus (*Phyaeter*), 572.
sindensis (*Crociodura*), 236.
sinensis (*Lepus*), 451.
sinensis (*Rhizomys*), 440.
sinensis (*Sotalia*), 585.
sinicus (*Macacus*), 23, 24.
Sirenia, 591.
skyn (*Agoceros*), 503.
sladeni (*Mus*), 406.
sladeni (*Sciurus*), 377.
Sloth-bear, 201.
smithii (*Oalictis*), 126.
smithi (*Herpestes*), 126.
Snow Leopard, 71.
soccatus (*Sorex*), 233.
sondaicus (*Bos*), 489.
sondaicus (*Gavvus*), 489.
sondaicus (*Rhinoceros*), 474.
songarus (*Orictes*), 481.
sonneratii (*Sorex*), 236.
Soricidae, 227.
soricipes (*Uropsilus*), 227.
Soriculus, 228.
Sotalia, 582.
spadiceus (*Sciuropterus*), 363.
Spalacidae, 437.
Spalacomys, 421.
spasma (*Megaderma*), 294.
spatagus (*Erinaceus*), 215.
speciosus (*Inuus*), 17.
speciosus (*Megaderma*), 294.

- spelæa (*Eonycteris*), 266.
 speoris (*Hipposiderus*), 287.
 speoris (*Phyllorhina*), 287.
Spermophilus, 391.
 Sperm-whale, 571.
 spinulosa (*Leggada*), 418.
 spirocerus (*Bos*), 492.
 Squamata, 595.
 squamipes (*Anurosorex*), 245.
 Squirrels, 369.
 Stag, Kashmir, 535.
 Steno, 582.
 stenoccephalus (*Rhinoceros*), 472.
 Stenops, 44.
 Stork, 165.
 stoliczkana (*Crociodura*), 238.
 stoliczkana (*Mustela*), 171.
 stoliczkana (*Putorius*), 171.
 stoliczkanus (*Arvicola*), 430.
 stoliczkanus (*Hipposiderus*), 290.
 stoliczkanus (*Microtus*), 430.
 stracheyi (*Arvicola*), 431.
 stracheyi (*Microtus*), 431.
 stricta (*Hyæna*), 132.
 strictus (*Paradoxurus*), 109.
 strigidorsa (*Mustela*), 170.
 strigidorsus (*Putorius*), 170.
 strophiatu (*Mus*), 417.
 Stylocerus, 531.
 subbadius (*Rhinolophus*), 277, 289, 290.
 subcristata (*Hystrix*), 445.
 subflaviventris (*Sciurus*), 376.
 subfulva (*Crociodura*), 241.
 subgutturosa (*Antilope*), 528.
 subgutturosa (*Gazella*), 528.
 subhemachalana (*Mustela*), 166.
 subhemachalanus (*Putorius*), 166.
 subhemachalus (*Felis*), 484.
 sublimis (*Mus*), 415.
 sublineatus (*Sciurus*), 385.
 sub-4-cornutus (*Antilope*), 519.
 subquadricornutus (*Tetracerus*), 529.
 Subungulata, 462.
 Suidæ, 559.
 suilla (*Gymnura*), 221, 602.
 suilla (*Murina*), 326.
 suillus (*Harpyiocephalus*), 328.
 suillus (*Hylomys*), 221, 602.
 Suina, 559.
 sumatrana (*Felis*), 78.
 sumatrana (*Lutra*), 187.
 sumatranus (*Ceratorhinus*), 476.
 sumatranus (*Elephas*), 463, 602.
 sumatranus (*Rhinoceros*), 476.
 sumatrensis (*Antilope*), 514.
 sumatrensis (*Capricornis*), 514.
 sumatrensis (*Ceratorhinus*), 476.
 sumatrensis (*Nemorhædus*), 514.
 sumatrensis (*Rhinoceros*), 476.
 sumatrensis (*Rhizomys*), 439.
 Sus, 559.
 Swamp-deer, 540.
 swinhoei (*Gerbillus*), 400.
 swinhoei (*Nemorhædus*), 513.
 sylhetanus (*Bos*), 487.
 sylvaticus (*Mus*), 416.
 Syncerus, 483.
 syndactylus (*Hylobates*), 9.
 Synotus, 298.
 syriacus (*Ursus*), 205.
 tabernaculi (*Halicore*), 593.
 Tæniogale, 119.
 Tahr, 509.
 Takin, 515.
 Talpa, 223.
 Talpidæ, 222.
 talpinus (*Ellobius*), 435.
 tamulicus (*Cervulus*), 532.
 tana (*Tupaia*), 212.
 tangalunga (*Viverra*), 99.
 Taphozous, 345.
 Tapir, 478.
 Tapiridæ, 478.
 Tapirus, 478.
 taraiensis (*Lutra*), 182, 185.
 tarayensis (*Mus*), 423.
 tardigradus (*Nycticebus*), 44.
 taurus (*Bos*), 483.
 taxicolor (*Budorcas*), 515.
 taxoides (*Arctonyx*), 180.
 taxus (*Mæles*), 181.
 Tehr, 509.
 Telemetacarpus, 531.
 temminckii (*Felis*), 75.
 temminckii (*Nycticejus*), 320.
 temminckii (*Galeopithecus*), 249.
 temminckii (*Scotophilus*), 320.
 temon (*Mustela*), 168.
 templetoni (*Hipposiderus*), 287.
 tenasscrimensis (*Felis*), 78.
 tennantii (*Sciurus*), 374.
 tenuis (*Nyctinomus*), 354.
 terricolor (*Mus*), 416.
 Tetracerus, 519.
 Thameng, 541.
 thar (*Antilope*), 513.
 thar (*Nemorhædus*), 513.
 theobaldi (*Mus*), 414.
 theobaldi (*Myotis*), 331.
 theobaldi (*Taphozous*), 348.
 thersites (*Presbytis*), 34.
 thibetanus (*Ursus*), 197.
 thricolis (*Arvicola*), 433.
 thysanurus (*Herpestes*), 126.
 tibetanus (*Arctomys*), 388, 389.
 tibetanus (*Helarctos*), 197.
 tibetanus (*Lagomys*), 456.
 tibetanus (*Lepus*), 452.
 tibetanus (*Macacus*), 18.
 tibetanus (*Putorius*), 163.
 tickelli (*Nycticejus*), 317.
 tickelli (*Vesperugo*), 317.
 Tiger, 58, 601.
 tigris (*Felis*), 58, 601.
 timidus (*Lepus*), 450.
 timoriensis (*Nyctophilus*), 299.
 Toddy-Cat, 108.
 torquata (*Felis*), 84, 85.

- torquatus (Chiromelas), 353.
 torquatus (Ursus), 197.
 toufæus (Martes), 160.
 tragatus (Nyctinomus), 353.
 tragatus (Rhinolophus), 279.
 tragocamelus (Antilope), 517.
 tragocamelus (Boselaphus), 517.
 tragocamelus (Portax), 518.
 Tragomma, 525.
 Tragops, 525.
 Tragulidæ, 554.
 Tragulina, 554.
 Tragulus, 554.
 travancorensis (Croci-
 dura), 241.
 Tree-Shrews, 208.
 Triænopis, 280.
 Trichys, 447.
 tridens (Hipposiderus), 282.
 tridens (Phyllorhina), 282.
 tridens, var. murraiana (Phyllorhina), 282.
 trifida (Phyllorhina), 290.
 trifoliatus (Rhinolophus), 272.
 Trilaticus, 328.
 trilineatus (Sciurus), 385.
 tristriatus (Sciurus), 384.
 trivirgata (Arctogale), 115.
 trivirgata (Paguma), 115.
 tubinaris (Harpyiocephalus), 324.
 tulliana (Felis), 72.
 Tupania, 208.
 Tupaiidæ, 207.
 turnbulli (Sciuroptera), 367.
 tursio (Delphinus), 581.
 tursio (Tursiops), 581.
 Tursiops, 581.
 Tylonycteris pachypus, 307.
 Tylopoda, 558.
 tylopus (Vesperugo), 602.
 typus (Paradoxurus), 106.
 tytleri (Lepus), 450.
 tytleri (Mus), 413.
 tytleri (Sorex), 234.
 tytleri (Paradoxurus), 112.
 uncia (Felis), 71.
 undata (Felis), 78.
 undulata (Viverra), 96.
 Ungulata, 400.
 Ungulata vera, 407.
 unicolor (Cervus), 543.
 unicornis (Rhinoceros), 472.
 urbanus (Mus), 413.
 Urial, 497.
 Urotragus, 516.
 Ursidæ, 192.
 ursinus (Melursus), 201.
 ursinus (Presbytis), 36.
 ursinus (Semnopithecus), 36.
 Ursitaxus, 175.
 Ursus, 193.
 Urva, 119.
 urva (Gulo), 129.
 urva (Herpestes), 129.
 vaginalis (Cervulus), 532.
 vaginalis (Cervus), 532.
 Vandeleuria, 402.
 variabilis (Lepus), 453.
 velox (Delphinus), 588.
 Vespertilio, 328.
 Vespertilionidæ, 295.
 Vesperugo, 300.
 Vesperus, 302.
 vestitus (Rhizomys), 440.
 veter (Silenus), 16.
 veter (Simia), 35.
 vetulus (Cercopithecus), 34.
 viculorum (Mus), 413.
 vignei (Caprovius), 497.
 vignei (Ovis), 497.
 villosus (Sciuropterus), 369.
 viridescens (Sorex), 234.
 vitticollis (Herpestes), 128.
 vitticollis (Mangusta), 128.
 Viverra, 95.
 viverriceps (Felis), 76.
 Vivericula, 100.
 Viverridæ, 94.
 viverrina (Felis), 76.
 Viverrinæ, 95.
 volans (Galeopithecus), 249.
 volans (Lemur), 249.
 Voles, 429.
 vulgaris (Hipposiderus), 288.
 vulgaris (Lutra), 182, 601.
 Vulpes, 147.
 vulpes (Canis), 153.
 vulpes indiens (Canis), 148.
 vulpes montana (Canis), 153.
 wagati (Felis), 78.
 waldemarii (Crocidura), 236.
 wallichii (Cervus), 535.
 warrigato (Capra), 511.
 Water-Shrews, 245.
 watsoni (Pelomys), 427.
 Weasels, 166.
 Whale, Indian Pilot, 577.
 Whales, 565.
 Whales, Ca'ing, 577.
 Wolf, 135.
 wyanei (Arvicola), 431.
 wynei (Microtus), 431.
 Xantharpyia, 261.
 xanthopygus (Cervus), 538.
 Yak, 490.
 yunnanensis (Hystrix), 445.
 yunnanensis (Mus), 406.
 yunnanensis (Pteromys), 364.
 yunnanensis (Rhinolophus), 275.
 zeylanicus (Paradoxurus), 111.
 zeylonensis (Hystrix), 442.
 zeylonensis (Paradoxurus), 112, 601.
 zeylonensis (Sus), 560.
 zibellina (Martes), 161.
 zibetha (Viverra), 96.
 Ziphiinæ, 570.

